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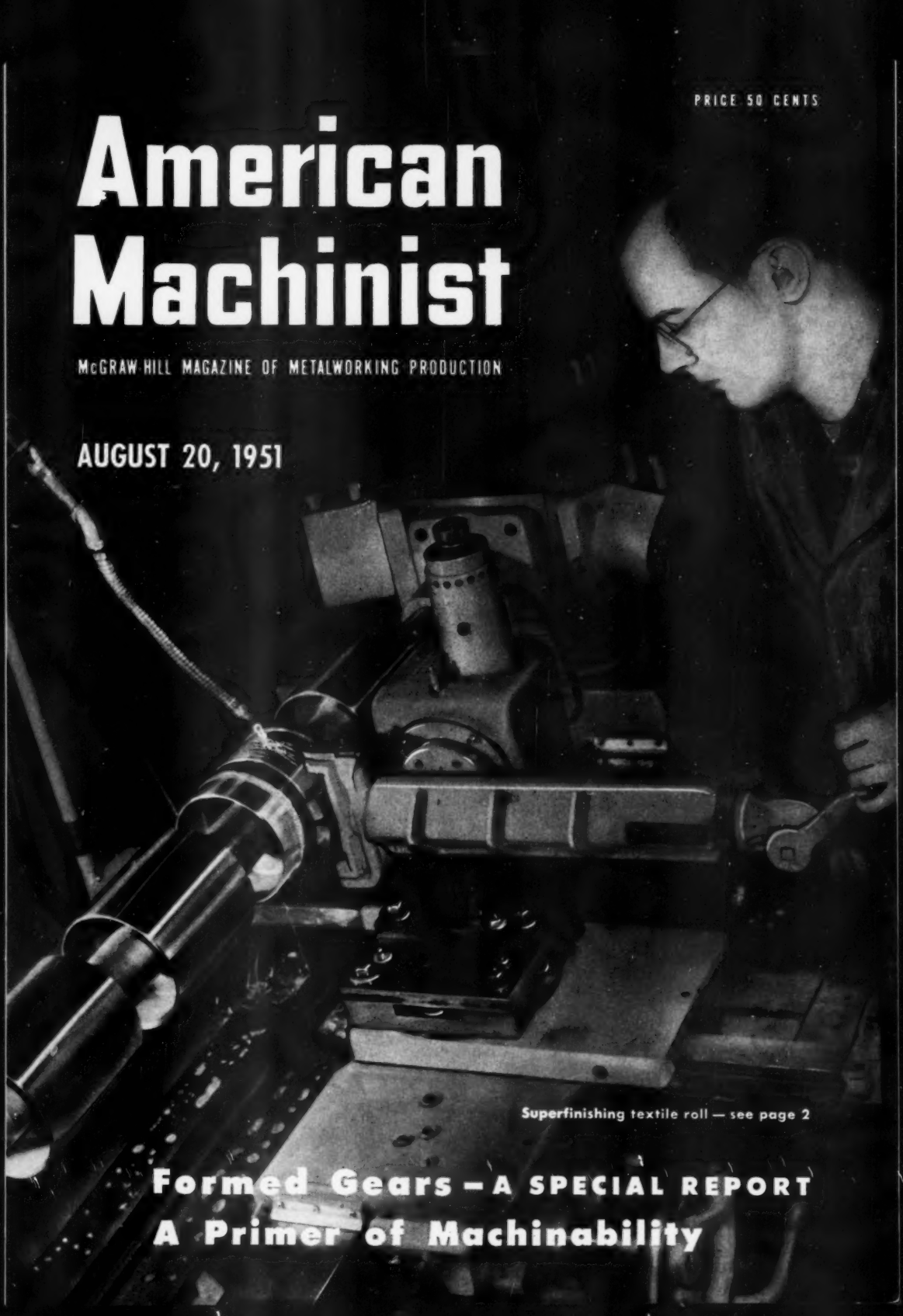
American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

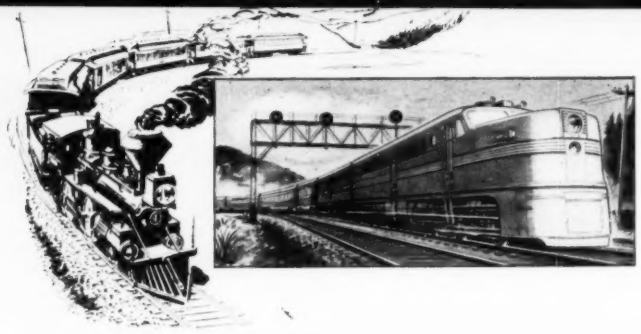
AUGUST 20, 1951



Superfinishing textile roll — see page 2

Formed Gears — A SPECIAL REPORT

A Primer of Machinability



FASTER NOW—and BETTER, TOO

—because Heald machines have helped to set the pace for faster, better production of precision finished parts

Today's trend to faster and faster production has been accomplished with no sacrifice in quality. In fact—where Heald machines are concerned—speed and precision have gone hand in hand. With every new development for faster, more efficient production, there has been an equal or greater increase in accuracy and precision.

It didn't just happen that way. It is the result of Heald's philosophy—that the trend must be ever upward, in *quality* as well as *quantity*. That's why Heald Bore-Matics and grinders have consistently set the pace for faster, easier and better production. Remember—when it comes to precision finishing, it pays to come to Heald.

Diesel Locomotive Pistons Finished

FOUR TIMES FASTER

on a New Heald Model 522 Bore-Matic

In this case HERE'S WHY

1. **FIVE OPERATIONS COMBINED** on one machine—pistons are bored, chamfered, faced, grooved and relief-undercut in a single setup.

2. **FULLY AUTOMATIC CYCLE**—all five operations are performed automatically in sequence, on two parts at a time.

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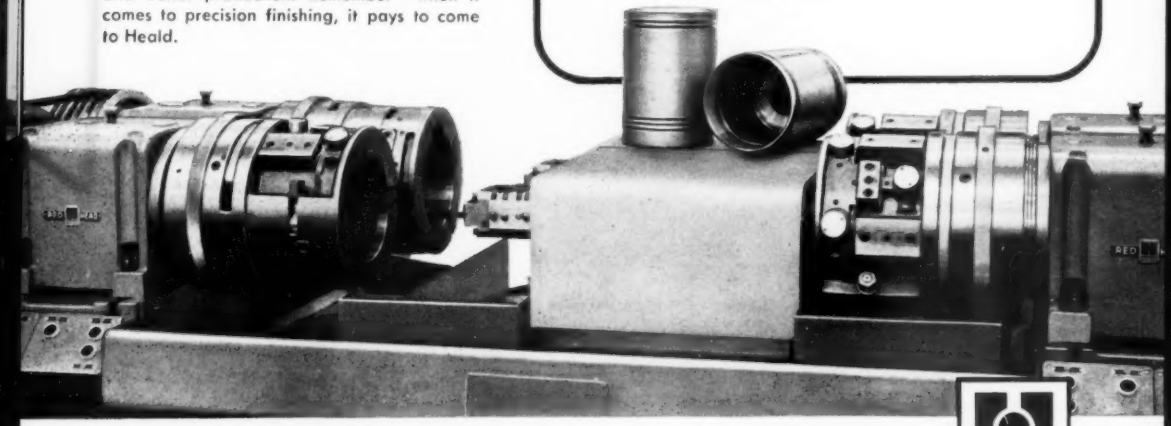

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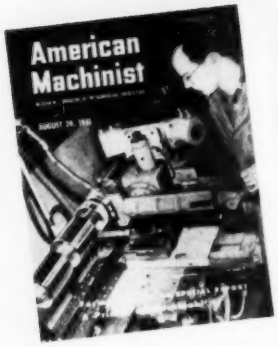


Chips and QUIPS

Special Job... Our cover photograph was taken in the Superfinish Laboratory of the Gisholt Machine Company, Madison, Wis. Here, customer's samples are Superfinished at nominal cost and returned for testing. The workpiece shown is a bobbin windup drive roll. It is held between centers in a lathe and the Superfinishing is being done with a No. 3 attachment mounted on the side carriage. Actually, two separate rolls were Superfinished. The first was a soft roll previously ground to 16 mu-in., rms. The second roll had been chrome-plated and ground to 5-6 mu-in., rms. It was Superfinished down to 9½-2 mu-in.

The Flexichrome print was prepared by Sidney Boyum, plant photographer.

Spline Cutting... Don Thatcher, superintendent of the machine division, Plant 1, Maytag Co., describes how gear shapers form-cut splines to close tolerances. The equipment used permits minute adjustment of tooth spacing and tooth thickness, so setup errors are easily rectified, and the process is faster than hobbing . . . We also have a single page showing three unusual applications of a special portable milling head. It saves setups and time.

Machining Fundamentals . . . Milton Shaw and Prescott Smith of the Machine-Tool Laboratory at MIT (see biogs) have teamed up to prepare for us a 5-article series on the basic influence of metallurgical considerations upon machining. They develop rules or conceptions to help us understand how structure and prior treatment of metals influence machining rates. This is in direct contrast to the usual practice of discussing a specific job and leaving the reader to shift for himself for other situations.

Gear Compilation... Two papers at the recent American Gear Manufacturers meeting set us off on the idea of a Special Report on all the ways of making gear teeth without cutting, particularly the highly accurate methods. So we have condensations of both papers, one on powder-metal gears, the other on injection-molded plastic ones, plus data on cold-drawn and extruded pinion stock, on die casting, investment casting, and sand casting. The latter subjects were written by E. J. Tangerman, executive editor.

Tooling Tricks... You will recall that a few issues back we presented tooling tricks from Watertown Arsenal. In this issue, we have the same thing, but this time from Watervliet. These machining setups permit use of standard equipment on special jobs, yet save as much as 500% over conventional methods.

Direct-Plating Aluminum... By a recent method it is possible to chrome-plate aluminum without the usual preceding setups of copper and nickel or zinc plating. The secret is wet blasting, followed immediately by plating.

Low-Pressure Headache... When pneumatic tools and equipment do not perform as they should, the trouble is probably low air pressure, but before you buy a compressor, check the data given in the article in next issue by Edmund Powers. He gives causes and cures for low air pressure, so you can be sure you're right before you invest.

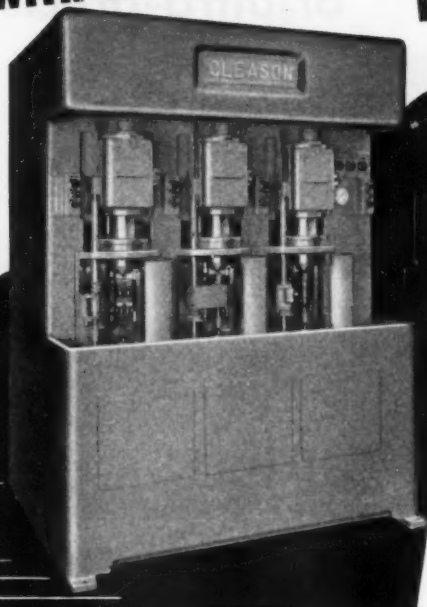
Handling Handicaps... As we promised in our Aug. 6 issue, we present herewith the story of Saco-Lowell's modern approach to materials handling. The proper integration of standard recognized units has resulted in an excellent in-plant transportation system, despite multi-story buildings, variable routings, and many small-lot jobs.

Coming... *AM* for Sept. 3 will feature a double-length 32-page Special Report, showing how American Locomotive Company and General Electric collaborate to build diesel-electric locomotives. There will also be a story on induction soldering, a threading report on multiple bending, and a spread of detailed tooling pictures, plus departments.

RESEARCHER . . . Dr. Milton C. Shaw received his undergraduate training at Drexel, earned his doctorate at the University of Cincinnati as a Cincinnati Milling Machine Company fellow. After research work with that machine tool builder, he spent the war years with the National Advisory Committee for Aeronautics, leaving the position of Chief of the Materials Branch to join M.I.T. Dr. Shaw is in charge of the Machine Tool and Metal Cutting Division of the Mech. Engrg. Dept.

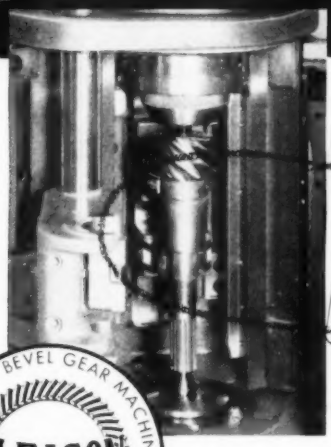
CO-RESEARCHER . . . Prescott A. Smith graduated from Massachusetts Institute of Technology in 1935. Subsequently he spent ten years in industry as equipment engineer, methods engineer, plant engineer, tool engineer and factory manager. He returned to the Institute in 1945 as a member of the faculty, and he is now in charge of the Machine Tool Laboratory.

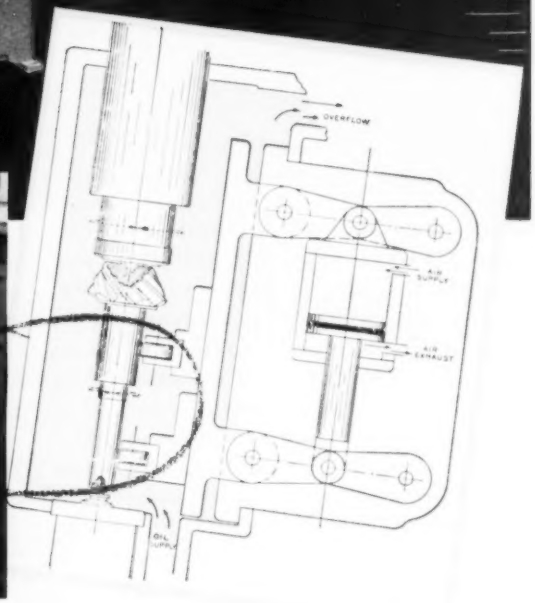
ELIMINATE DISTORTION
WITH THE GLEASON No. 16 PINION QUENCHING PRESS



The Gleason No. 16 Pinion Quenching Machine is a distinctively different type of quenching machine. It is designed with three multiple units, each operating independently of the other and assures continuous fast production of hardened pinions. Further straightening of shafts is unnecessary.

A pre-set metallurgically correct oil flow is provided which, when once set, makes this machine completely automatic in operation from the time the pinion is placed in the loader jaws until it has passed through the quench and returned to unloading position. During the quench, while rotating on centers, shafts are held against rollers to prevent distortion.





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GLEASON
FOR OVER EIGHTY-FIVE YEARS

Write for more information on this modern way of pinion quenching.

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1000 UNIVERSITY AVENUE · ROCHESTER 3, NEW YORK

New line-up for *of ultra-precision*

Tandem setups for thrufeed centerless grinding operations are well known to the high production industries. But not so well known is the latest method of harnessing CINCINNATI FILMATIC Centerless Grinders together to simplify sizing adjustments and resetting as necessitated by changing blades or wheels. It works this way:

> A Feedmatic Hopper automatically loads the work in the first machine. Thereafter, individually motor driven conveyors take over. They are mounted on the machines at the entrance side of the grinding throat and freely supported at the rear of the preceding machine. As the work leaves one machine, it is dropped on the conveyor for the next machine by a counterweighted escape device. Thus each unit can be individually adjusted without affecting the others, and it is unnecessary to maintain a straight line laterally.

To improve surface finish beyond the best obtainable by grinding, a CINCINNATI FILMATIC Centerless Lapping Machine can be placed at the end of the line of Centerless Grinders, as has been done in the production line illustrated. Setups of this type produce exceptionally high-quality work, with very little attention from the operator at each end of the line. ¶ CINCINNATI FILMATIC Centerless Grinders offer many advantages for continuous line production or job lots. FILMATIC grinding wheel spindle bearings will never fail; lubrication, including the infeed slides, is automatic; electrical control elements are built-in. And, to top it off, Cincinnati Application Engineers can give you the benefit of 25 years' experience in centerless work. They'll be glad to help you with your high priority production problems.

CINCINNATI GRINDERS INCORPORATED
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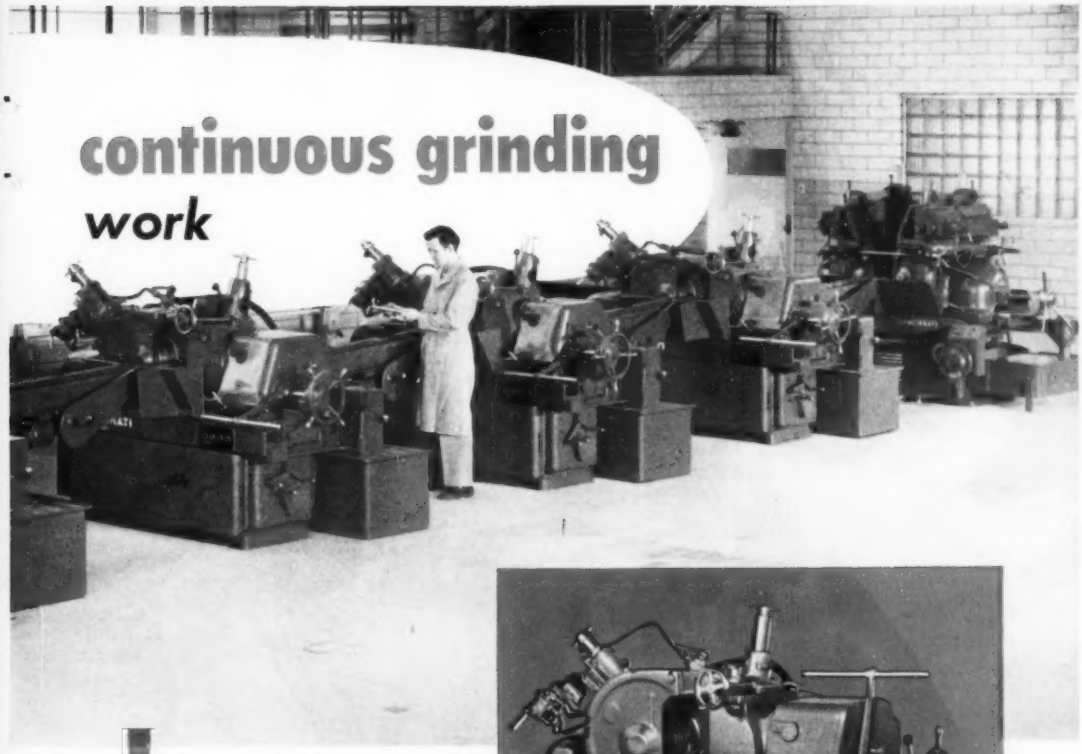
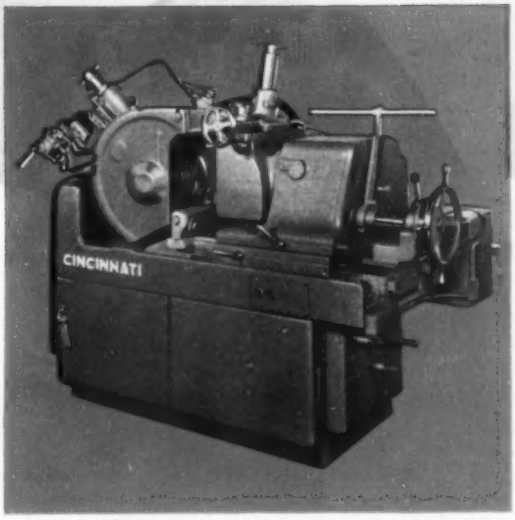
continuous grinding work



Grinding rocker arm shafts, 16¾" long; removing .015" to .020" stock on 170 shafts per hour. Shafts are selective hardened, and delivered to the grinder in varying degrees of straightness. The production line consists of five CINCINNATI FILMATIC No. 2 Centerless Grinders and one CINCINNATI FILMATIC Centerless Lapping Machine.



CINCINNATI FILMATIC No. 2 Centerless Grinder. Complete specifications may be obtained by writing for catalog No. G-591-1.

CINCINNATI Feedmatic Hopper. Type E illustrated for thrufeed work. Type B, for infeed work, also available. Catalog No. G-575.

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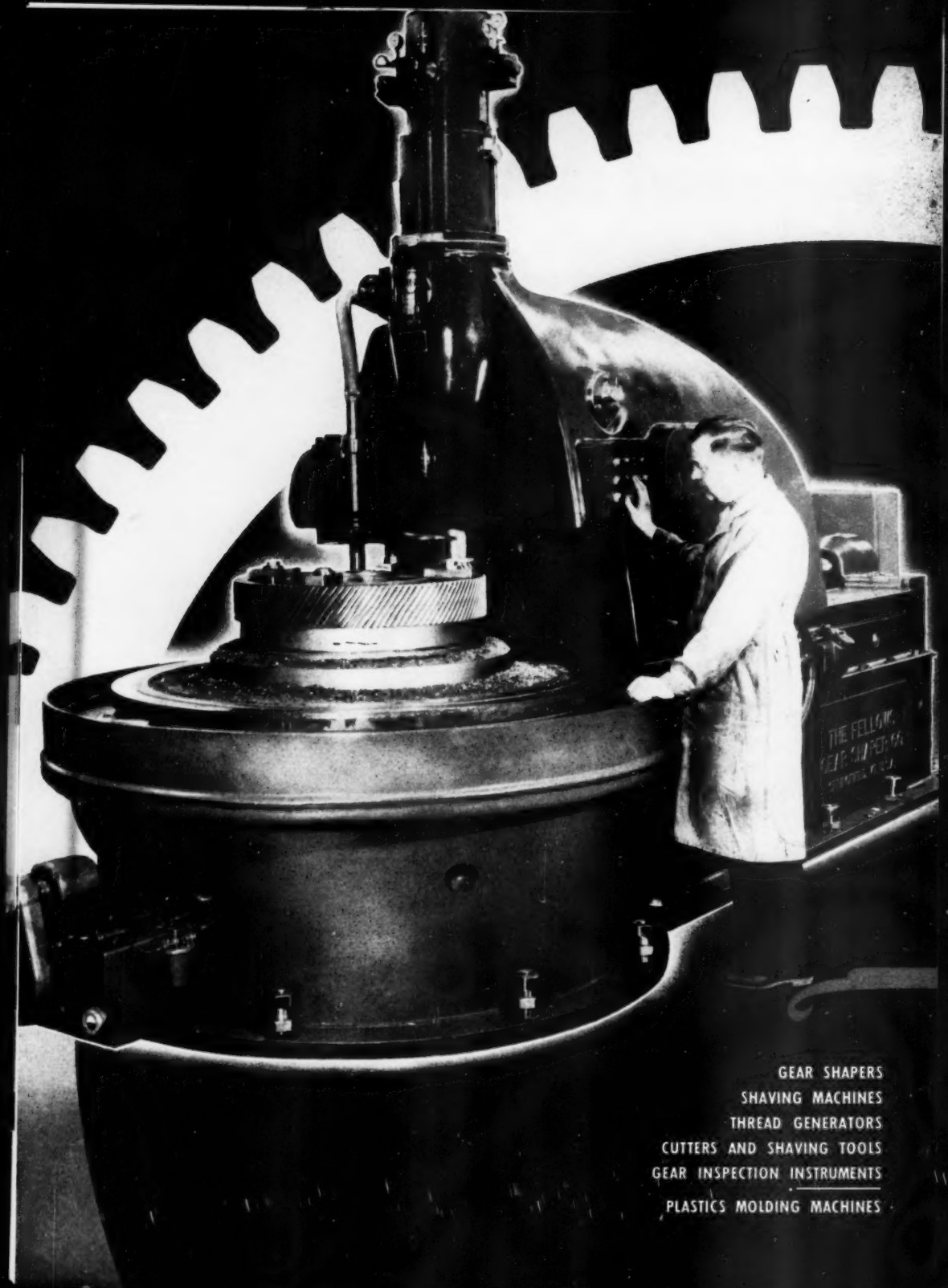
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES



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SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

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If there's a Job to do on BIG GEARS

The Fellows 100-Inch Gear Shaper is at Your Command

Internal and external gears as large as 100 inches pitch diameter and 8 inches face width can be cut to a high degree of accuracy with ease and dispatch... Now available with a new relieving cutter-spindle, adapting the machine to the cutting of external and internal helical gears—as well as spur gears... Power, weight and rigidity to take heavy cuts on coarse-pitch work, and the precision necessary for the finer finishing cuts... All this is wrapped up in the Fellows 100-Inch Gear Shaper... Any one of the Fellows offices will be glad to supply complete data and specifications.

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The Van Norman No. 38 Miller gives you many cost-cutting advantages not found in any other miller of this type. The heavy, rugged column and sturdy ram are constructed to take all types of cuts including carbide milling. The massive cutterhead has a 10 HP motor driving the spindle, providing a 100% increase in power. Cutterhead speeds have been increased to 2000 RPM for high speed work.

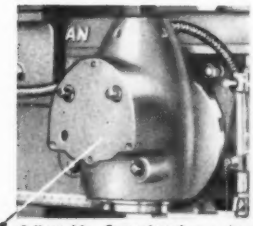
It will pay you to investigate the advantages of this New No. 38. Check its features against other millers and you'll find it gives you greater opportunities to cut costs and increase production. Write for information.

Production Work Hours . . .

VAN NORMAN No. 38

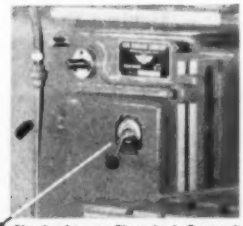
RAM TYPE MILLING MACHINE

A Heavy-Duty Miller that provides many cost-cutting advantages

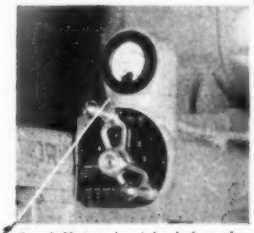


Adjustable Cutterhead permits horizontal, angular and vertical milling on *one* machine. Graduated in degrees for easy positioning.

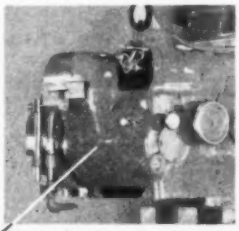
Front and Rear Controls of all power feeds can be operated from either position. Manual controls are also at front and rear.



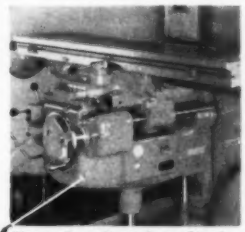
Single Lever Electrical Control controls spindle, feed, and coolant. The same lever reverses spindle direction.



Load Meter is right before the operator's eyes . . . gives visual indication of the "percent of load" that the machine is being operated under.



Massive Ram is heavier and stronger than on other machines. It is reinforced throughout for ruggedness and long life.



Heavy-Duty Knee Assembly, including table and saddle, is designed as an integral unit to provide maximum rigidity and accuracy.

VAN NORMAN COMPANY
SPRINGFIELD 7, MASSACHUSETTS

LANDIS WORLD'S

THREAD ENGINEERING DEVELOPMENTS FOR DEFENSE PRODUCTION

MACHINE LARGEST

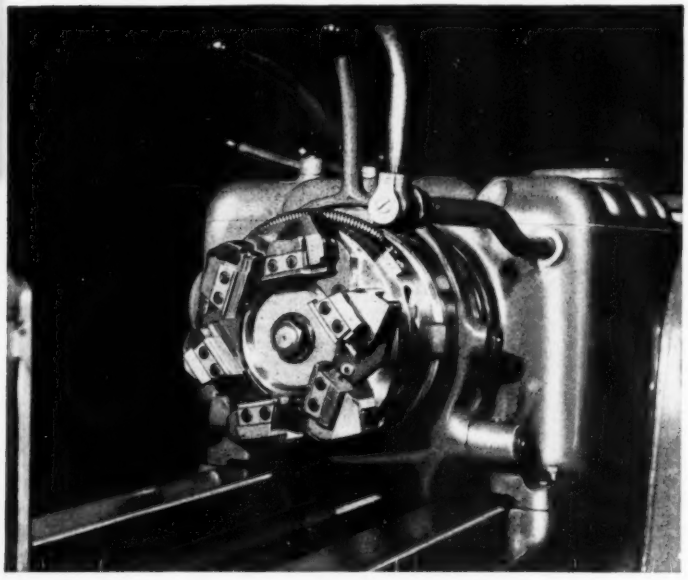
Landmaco Machine Adapted For Threading U. S. Navy Rockets

A LANDMACO Threading Machine, through special tooling devised by our Engineering Department, was recently adapted for use by a southwestern manufacturer for the precision threading of 5" Mark 6 Navy Rockets.

JOB REQUIREMENTS:

Specifications required the generation of 4¾" diameter 12-pitch threads on the rocket head. As a result of the design of the rocket this threading operation had been a trouble spot in the manufacturing process.

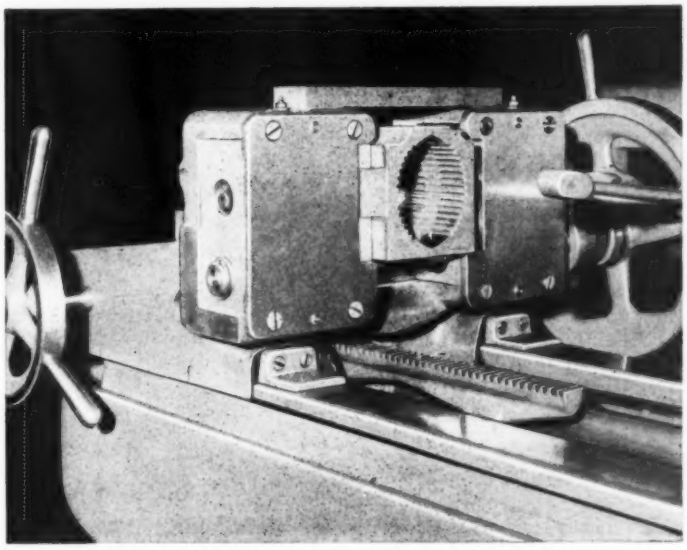
Concentricity limits had to be held between thread and the section of the workpiece projecting in front of the thread. It had been difficult to maintain the exact tolerances required. One of the problems arose from the fact that the diameter of the forepart of the projection was larger than the root diameter of the thread. Detailed specifications and engineering drawings of the rocket head are not available for security reasons.



THREADING EQUIPMENT USED:

Today precision threads are being cut on these rocket heads at high production rates, and the threads are held to close concentricity. A battery of three 2½" Single Head LANDMACO

Leadscrew Threading Machines are used in the operations, each equipped with Special Tooling devised to meet the problems of this specific job.



SPECIAL TOOLING:

1. *40RX LANCO Head.* This head features the use of six chasers, thus distributing the cutting strains over a larger number of threading tools. This results in a finer thread finish and longer tool life.

2. *Receding-type centering pilot.* The bore of each head is fitted with this pilot to maintain close concentricity. The pilot is slightly tapered so that it fits over the front end of the rocket head. Thus, before the work is gripped in the vise, it is engaged by the centering pilot while the head is open. A relief between the start of the thread and the larger diameter of the projection provides the clearance necessary for the head to close.

3. *Heavy-duty Vise.* It is adjustable both vertically and horizontally for easy operation. A metal tie is doweled and bolted to the top of the vise as reinforcement to assure maximum strength and rigidity. The vise has round, serrated grips, precision-ground to insure uniform gripping surfaces.

4. *Hammer-blow hand-wheel.* Reduces operator-fatigue to a minimum, and precludes slippage of the workpiece and facilitates its removal.

5. *Hand-operated work-stop.* This assures maximum chucking efficiency and uniformity of thread length. The work stop also eliminates one cause of die breakage in that it accurately positions the work axially in the vise to prevent the chasers from striking against work shoulders.

This special adaptation of a standard LANDMACO Machine illustrates the utility of Landis Threading Equipment in the growing expansion of ordnance production. Landis Engineers have helped many manufacturers, just as this one, with their problems in thread production by recommending the proper equipment, and process for the job, and by devising special tooling for the job's unusual requirements. Perhaps your current thread production problem may be solved as successfully as this.

LANDIS

THE LANDIS MACHINE COMPANY
WAYNESBORO-6 • PENNSYLVANIA • U.S.A.

Production Up 90% with

modern LANDIS TOOL method

LANDIS TOOL
Precision Grinders

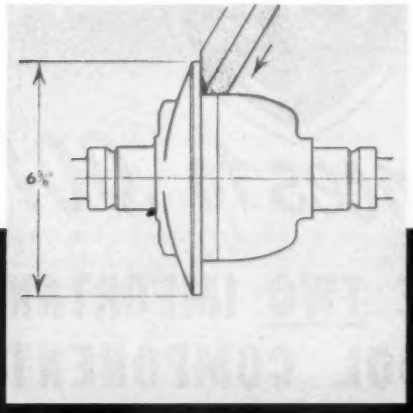
LANDIS TOOL 6" x 30" Type CH
PLAIN GRINDER WITH ANGULAR WHEELBASE
- Special Tooling
- Angular Wheelbase
- Hydraulic Infeed and Timer
- Right Angle Wheel Truing Fixture
- Lateral Locator

Finish Improved

combines two grinding operations

An automobile manufacturer reports almost doubled output of differential housings by changing from his former grinding method to this modern method engineered by Landis Tool. Previously, the job was done with a conventional wheelbase using a bumping operation to grind the shoulder. Both the diameter and the shoulder are now ground in a single operation with this new angular wheelbase grinder. A by-product is the highly superior finish on the two surfaces.

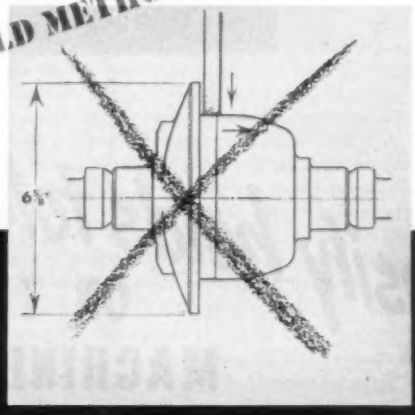
New Method



TWO SURFACES GROUND IN ONE OPERATION

Production: 135 per hour
Stock Removal: Diameter — .010"
Adjoining Shoulder — .005"

OLD METHOD

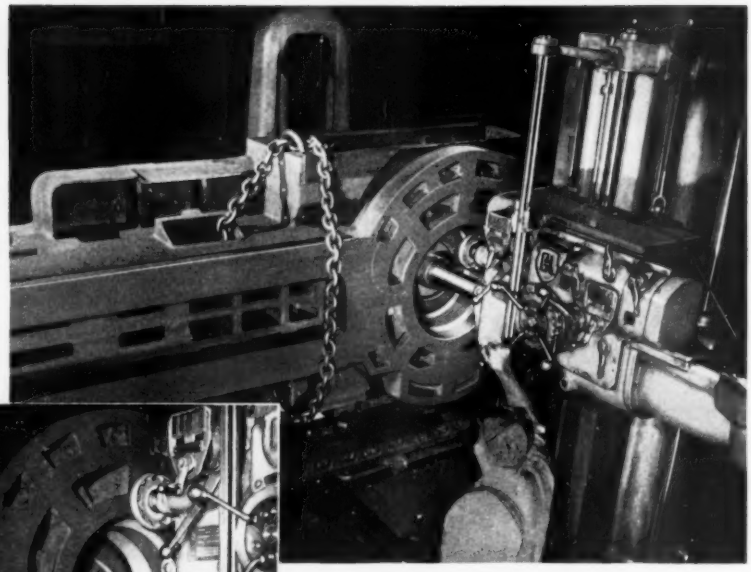


TWO OPERATIONS TO GRIND TWO SURFACES

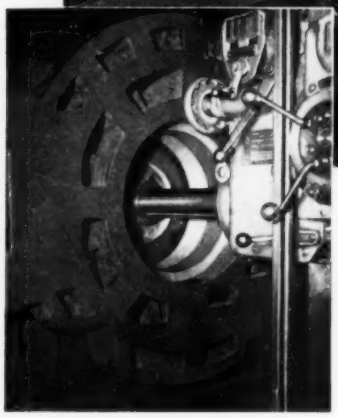
Diameter ground to size. Shoulder ground by moving work against side of wheel.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U.S.A.

Many machine tool builders now depend upon their G. & L. horizontal boring machines to perform boring operations such as this. Accuracy of the G. & L. and simplicity of work set-up solves many difficult problems.



Close up of the boring head showing the bearing seat bores for a rotating machine table. Three bores are easily held to .001" using this table type G. & L. machine.

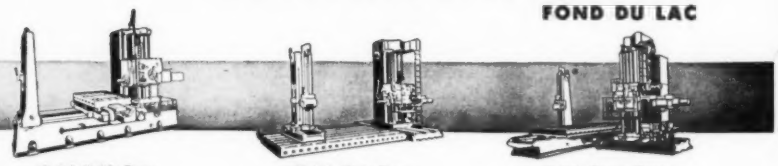


easily holds tolerances to .001"

ON THESE TWO IMPORTANT MACHINE TOOL COMPONENTS

GIDDINGS & LEWIS
FOND DU LAC

HYPRO

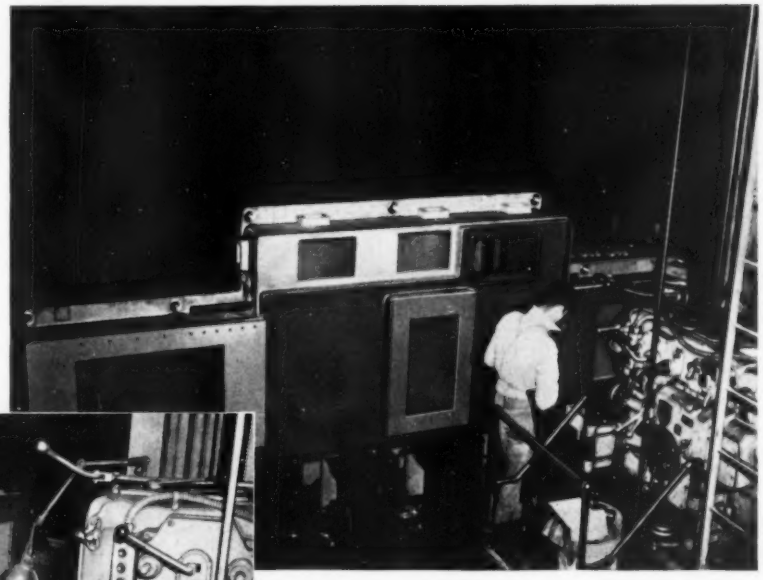


G. & L. Table Type Horizontal Boring Machine

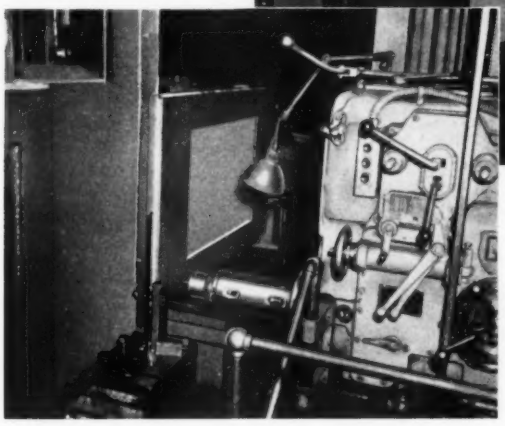
G. & L. Floor Type Horizontal Boring Machine

G. & L. Planer Type Horizontal Boring Machine

This G. & L. Floor Type Machine is used by a leading machine tool manufacturer to perform precision operations on a large way machine base where overall machining accuracy must be closely held.



Boring a series of locating pin holes for mounting unit heads on a way machine. These holes must be parallel within .001" of the base sides and provide the same tolerance for unit location both horizontally and vertically.



1 Machine Scales and Vernier Used to Locate Precision Bearing Bores

Another typical example of the built-in accuracy of G. & L. machines is the precision boring of a large machine tool base on which a machine table will be mounted. Three finish bores, 22.500" — 20.000" — 20.000", are made with a special boring head and held to a tolerance of .001". Machine scales and verniers are used to locate these bores. The dependability of G. & L. horizontal boring machines in producing important machine tool components makes it possible to produce more accurate units at less cost.

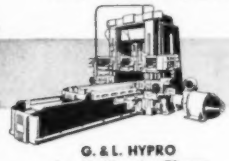
2 Manufacturers Rely on the Accuracy of Giddings & Lewis Machines to Bore Vital Locating Pin Holes

Rigid accuracy requirements are readily maintained with a G. & L. floor type horizontal boring machine in boring locating pin holes on a way machine base. Two way units are mounted on the opposing wings of the base and pin holes must be held parallel to ±.001" with the side of the strip for unit location vertically as well as horizontally. In addition to the precision boring on the wing, other machining operations are performed in the same work setting insuring accurate relationship of the machined surfaces, bores, drilled and tapped holes, etc., for final assembly.

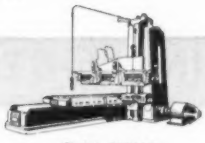
If you wish to lower your production costs and meet urgent delivery demands, G. & L. engineers will gladly study your machining problems and submit recommendations on simpler methods using horizontal boring, drilling and milling machines.

MACHINE TOOL COMPANY

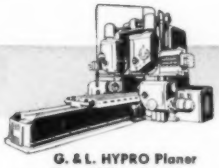
WISCONSIN, U. S. A.



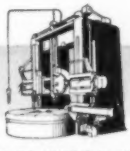
G. & L. HYPRO Double Housing Planer



G. & L. HYPRO Openside Planer



G. & L. HYPRO Planer Type Milling Machine



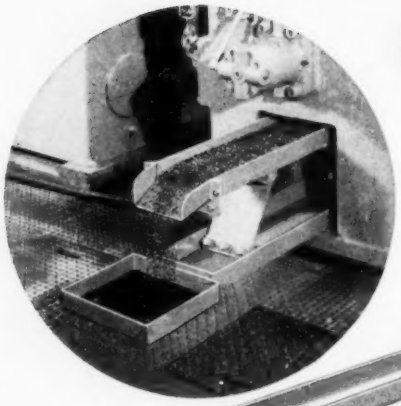
G. & L. HYPRO Vertical Boring and Turning Mill

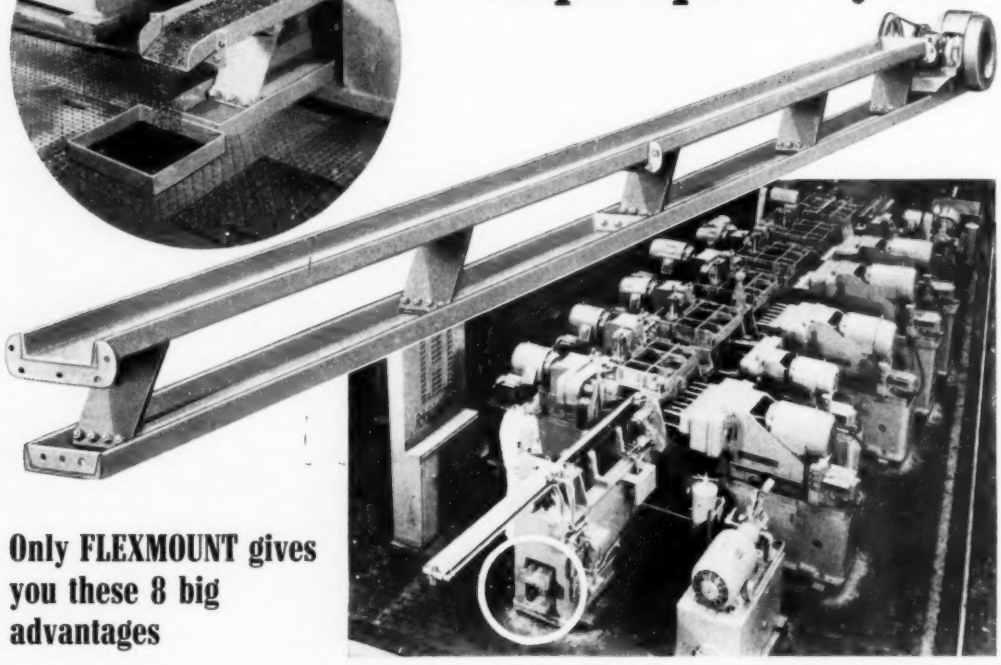
DAVIS

Complete Tooling Service

ANNOUNCING...

a remarkable, new chip-disposal system





FLEXMOUNT Oscillating Conveyors built into Cross automatic transfer-type machines for automotive production.

Only FLEXMOUNT gives you these 8 big advantages

1. POSITIVE ACTION. Uniform, continuous chip flow is assured regardless of load. Natural spring action reduces horsepower requirements to a minimum.
2. LEAK-PROOF. Trough is a single piece of metal. No coolant drip between machine and drain point. No return run.
3. COMPACT. A "natural" for restricted space. Opening need be only slightly larger than trough.
4. LONG LIFE. Minimum of moving parts. No joints or bearings in contact with material. The resilient legs that provide spring action last indefinitely.
5. LOW MAINTENANCE. Operates at low speed. Only drive need be lubricated.
6. SAFE. No moving parts in conveying trough.
7. JAM-PROOF. Reduces production stoppages. Handles bolts, nuts, bars, broken tools and even rags.
8. VERSATILE. Various widths, standard lengths up to 100 ft., with one drive. Dividers can be installed to convey simultaneously two or more materials, such as brass and steel chips, without mixing.

Link-Belt FLEXMOUNT Oscillating Conveyor is simple, compact... offers real savings in carrying off and collecting ferrous and non-ferrous chips

HERE'S the latest advance in chip disposal for high-production metal-working shops. Leading auto makers and machine tool builders are rapidly standardizing on new Link-Belt FLEXMOUNT Oscillating Conveyors—as integral equipment and as collecting conveyors for carrying chips to a central disposal point.

Check the outstanding operating advantages shown at left. See for yourself how the Link-Belt FLEXMOUNT meets the modern demand for improved chip handling.

LINK-BELT

FLEXMOUNT OSCILLATING CONVEYORS

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities. 12.413

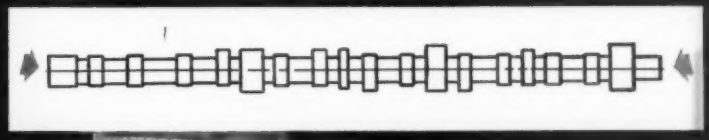
GARDNER

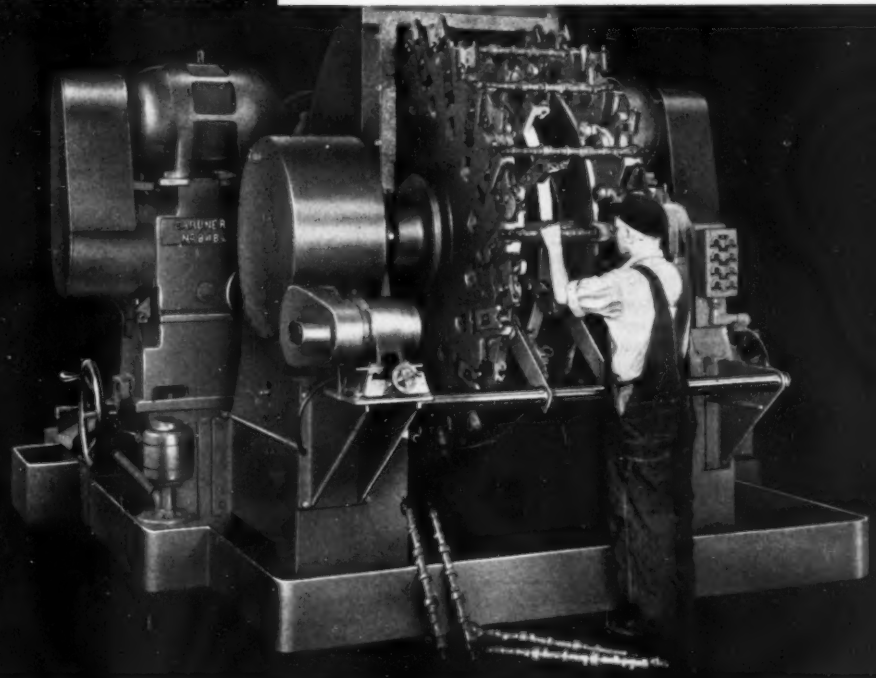
Precision disc Grinders

Snag Grinding 1,000 Shafts Per Hour Lowers Unit Costs

TWO ends of camshaft ground in ONE operation

$\frac{3}{8}$" max. stock removed from each end of high test cast iron shaft. Rotating work carrying fixture with gravity unloading. Gardner 84B-40" Double Disc Grinder.





104M

Request bulletin No. 12-7.

GARDNER MACHINE COMPANY

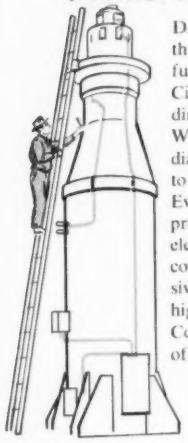
410 East Gardner Street • Beloit, Wisconsin, U.S.A.

ANACONDA METALS at work

Pictures "come to life"

Ever look through an old-time stereoscope? Remember the fascination of three-dimension pictures? Now add the vivid, full-color of Kodachrome and you have an idea of the breathtaking realism made possible with a View-Master Stereoscope – price, two dollars retail – anywhere in the U.S.A. But there's a lot of close-fitting, smooth-operating brass stampings in this device, and, when they're made at the rate of a million a year, there's no time for fussing with off-gage, off-temper metal. Anaconda Brass is the choice of Sawyer's Inc., Portland, Oregon, makers of the View-Master.

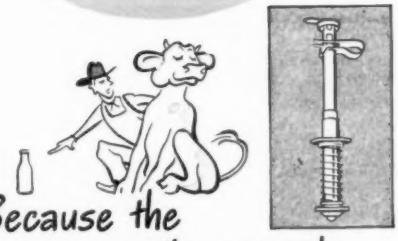
World's longest water tunnel



Driven through solid rock for 117 miles, this underground aqueduct will eliminate future water shortages in the New York City area. The new tunnel, built under the direction of the New York City Board of Water Supply, measures up to 21 feet in diameter and extends from the Catskills to New York City. Thousands of feet of Everdur Electrical Conduit are used to protect important control wiring for the electric sluice gate hoists, pumps and recording devices. Junction boxes in corrosive locations are also made of one of the high-strength, corrosion-resistant Everdur Copper-Silicon Alloys. Write for a copy of Publication E-12.

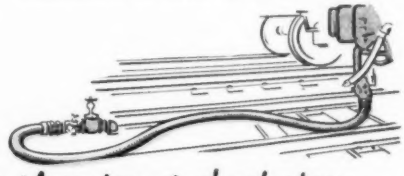
PS

With the rapid changeover facing American Industry today, much time can be saved by getting the right answer, quickly, to new metalworking problems. The service files of our Technical Department represent many years of experience with the metalworking field and contain much practical information on copper and copper alloy applications. If you feel we can help, don't hesitate to write, addressing The American Brass Company, Waterbury 20, Connecticut.



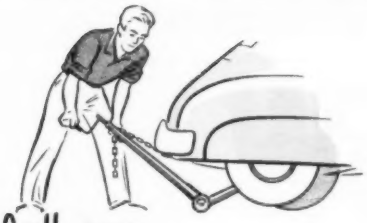
Because the cow won't cooperate

This unique milk-bottling valve features an air release tube telescoped into a second larger tube. Advantage: Fast air venting speeds up the bottle-filling operation. Anaconda Nickel Silver was selected for the most important parts because this silvery-white metal is attractive, readily workable, easy to clean – and keep clean. The Specialty Brass Company, Kenosha, Wisconsin, manufactures the Kleen-Fill Valve.



An "American" short story on railroading

Many of our railroads have found a simple, economical answer to the problem of supplying live steam to cars and coaches standing on sidings or in railroad terminals waiting for a locomotive to hook on. It's in the form of "American" Flexible Metal Tubing. No joints to repack – simple to connect and disconnect, they save dollars in steam and maintenance expense. There are thousands of other applications where "American" Flexible Metal Hose or Tubing is used to convey steam, oil, air and other liquids and gases. Cata'og CC-300 tells all. Want a copy?



Jack of all cars

Ever have trouble changing a flat on that low-slung car of yours? Well, here's a jack that eliminates the headache. Made by the Triangle Jack Co., Inc., of Wichita, Kansas, it can be instantly adjusted to suit the road clearance of any car. An Everdur Copper-Silicon Alloy is used for an important part of the screw mechanism because the manufacturer found it stronger, tougher and generally superior to all other non-ferrous metals tried.

We do this in self-defense

For many years our French Small Tube Branch has manufactured small diameter, thin-gage tubes of the highest accuracy commercially obtainable. One of the reasons for this is the constant use of the bore telescope on redraw stock . . . for a *small* defect in a large tube would mean a *large* defect in a small tube. Since a tube with an imperfect bore could not escape our final tests and inspection, it would be rejected and scrapped . . . hence, we have a mighty good reason for ferreting out any possible imperfections right at the start.

What's so fascinating about a fire hydrant?

It all depends on the point of view. To the city engineer it's a comforting thought to know the manufacturer used the right metal in the right place. The stem, for instance, is one of the most vulnerable parts of a hydrant. It is subject to unusual stresses, strain and corrosive attack—and it has to be there when you need it! Leading hydrant manufacturers are using Everdur Copper-Silicon Alloys in increasing quantities for stems, stem-nuts, seat rings, drip valve holders, washers, bolts, barrels and other parts where a strong, tough, corrosion-resistant metal is required.

No chance for replacement here

Expansion and contraction are important problems in bridge and highway construction. A bearing surface capable of supporting the tremendous, shifting weight of the superstructure must be provided. Bridge plates of Anaconda Rolled Phosphor Bronze, one of the best bearing metals known, have been installed in many of the country's largest structures, including the Macombs Dam Bridge approach of the Major Deegan Expressway, New York City. Fabricated with graphite-lubricated inserts in trepanned grooves by Merriman Brothers, Inc., Boston, and used in conjunction with a rocker assembly, these Anaconda Bridge Plates will withstand lateral movement in any direction from now on.

YOURS—FOR THE FIRST TIME!

25 years of corrosion-resistance data ...in 24 pages

This brand new booklet is the first of its kind in the brass industry. It explains the chemical and physical nature of corrosive attack in its various forms. Included is a tabulation indicating the relative corrosion resistance of the principal types of copper and copper base alloys when in contact with 183 different corroding agents frequently encountered. A penny post card will bring your copy of Publication B-36. Address: The American Brass Company, Waterbury 20, Conn.

ANACONDA

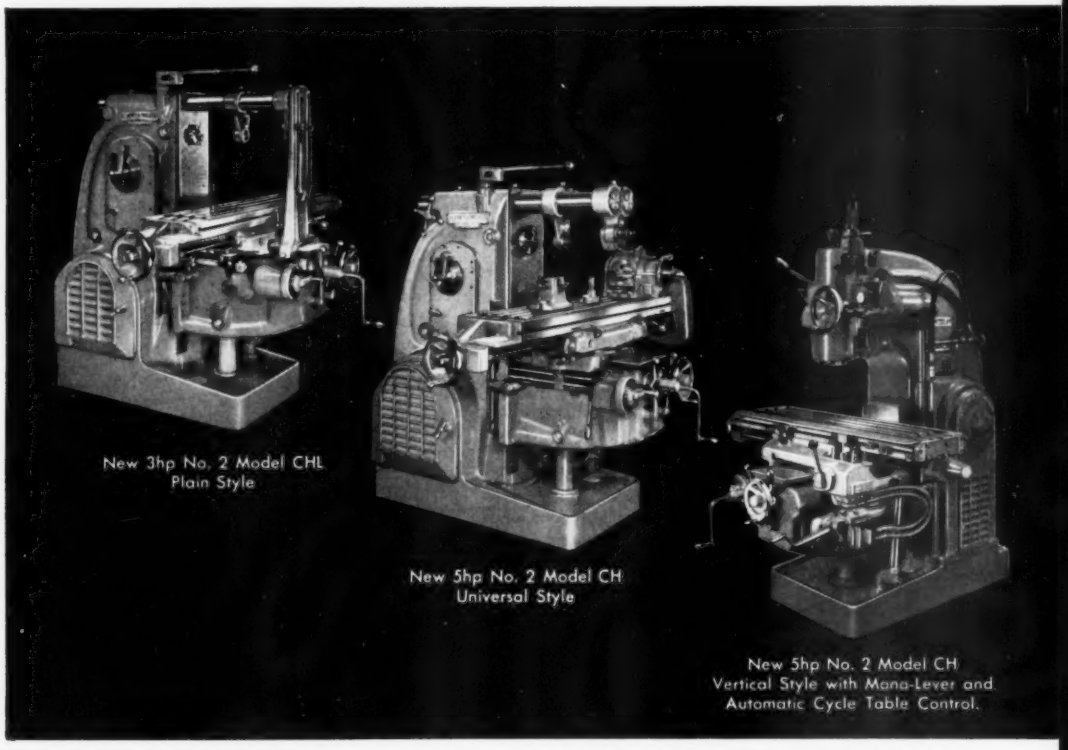
the name to remember in

COPPER·BRASS·BRONZE

51102

Kearney & Trecker Announces . . .

THREE NEW KNEE



New 3hp No. 2 Model CHL
Plain Style

New 5hp No. 2 Model CH
Universal Style

New 5hp No. 2 Model CH
Vertical Style with Mona-Lever and
Automatic Cycle Table Control.

The specifications below point up the new larger working ranges of these new Kearney & Trecker machines. You'll find these larger working ranges provide you with new major cost-cutting possibilities for both tool-room and production work — long or short runs. Feeds and speeds listed are standard ranges. Optional ranges are available at extra cost.

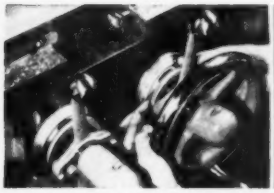
Machine	TABLE					SPINDLE	
	Working Surface	Power Feed Travel		Feeds Number & Range	Power Rapid Traverse — " Per Min.	Nat'l Std. Taper	Speeds — Number and Range
		Plain & Universal	Vertical				
No. 1 Model CH Plain, Universal and (swivel head) Vertical	40" x 10½"	Long. 22"	22"	16—⅛" to 32"	150"	40	16 — 25 to 1500 RPM
		Cross 8"	10"				
		Vert. 17"	16"	16—¼" to 16"	75"		
No. 2 Model CHL Plain, Universal and (swivel head) Vertical	46" x 10½"	Long. 28"	28"	16—⅛" to 32"	150"	40	16 — 25 to 1500 RPM
		Cross 10"	10"				
		Vert. 17"	16"	16—¼" to 16"	75"		
No. 2 Model CH Plain, Universal and (sliding head) Vertical	50" x 12"	Long. 28"	28"	16—¼" to 32"	150"—plain & vert. 100"—universal	50	16 — 25 to 1500 RPM
		Cross 10"	12"				
		Vert. 18"	15"*	16—⅛" to 16"	75"—plain & vert. 50"—universal		

*Add 4" vertical travel for sliding head

TYPE MACHINES

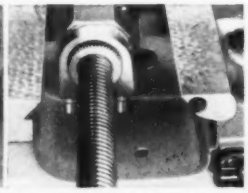
3 and 5 Horsepower

New Kearney & Trecker No. 1 CH, No. 2 CHL and No. 2 CH Milling Machines (Plain Universal and Vertical Styles) have every performance-proven operating and construction feature needed for modern short-run or production milling requirements

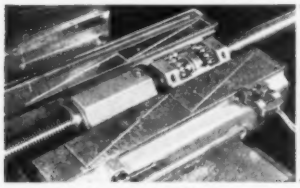


Positive locking, rapid-set dials are vapor blasted, for high visibility — avoid costly setting errors.

Wider feed and speed ranges meet modern cutting tool requirements — optional ranges available.

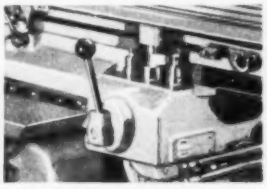


Extra large dia. table feed screw and extra long bronze nut with backlash eliminator gives better climb milling performance.



Positive metered pressure lubrication to saddle, table and knee ways and table feed assembly assure greater machine life.

3-bearing spindle design provides solid support for greater rigidity and cutting efficiency using modern cutting tools.



Mono-Lever and Automatic Cycle Table Control (optional) provides high speed production on long or short runs — cuts operator fatigue.

New, heavier columns are scientifically designed to absorb vibration from heavy cutting loads... give greater overall rigidity.

If you're looking forward to modernizing your tool-room or milling machine line — you can't afford to overlook these new 3 and 5hp knee types. They offer you wider working ranges, more practical operating features and heavier construction than any comparable equipment. They've been designed to fully answer today's milling needs — and tomorrow's as well. For complete data on these machines, contact your Kearney & Trecker representative or write direct. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

Skilled help for your defense work is available!

● Today we can't offer immediate delivery on new machine tools. But we do offer skilled help—our 45 Warner & Swasey Field Engineers.

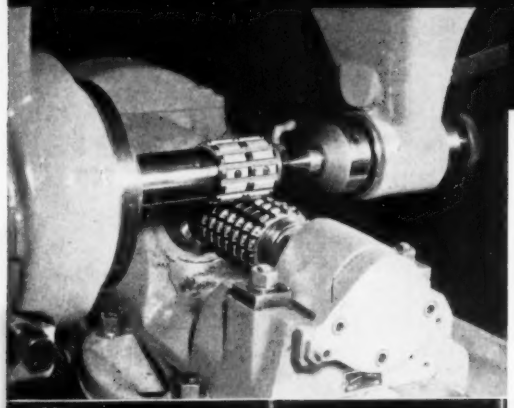
If yours is a typical metalworking plant—with machines averaging 10 or more years of age—chances are you need this help to increase the productivity of your machines.

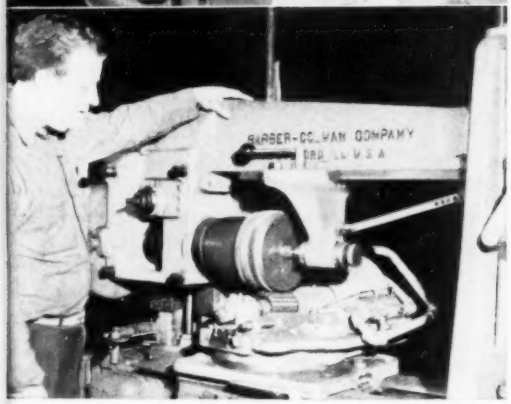
Perhaps one of our Field Engineers can help you. His suggestions may be surprisingly simple—a new part, a different tool, an easy-to-make adjustment. But when he leaves your plant, your machines undoubtedly will be producing more than when he came in.

This is not a war-born service. The Warner & Swasey man who calls on you was *trained* for this job. He has helped increase production in hundreds of plants. His service is typical of Warner & Swasey's long-standing policy of putting the customer *first*—of working with each customer individually to best serve his particular requirements.

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY TURRET LATHES, AUTOMATICS AND TAPPING MACHINES

Hob Splined Pulleys with Relative Key Location— Tooth Spacing Assures Accurate Timing





● Straight-sided spline teeth on driving pulleys for industrial sewing machines are hobbed on Barber-Colman No. 16-16 Hobbing Machines as shown in this set-up. Tooth spacing must be held to assure correct timing of the mechanism. Conversion of the job to No. 16-16 Hobbing Machine resulted in a reduction of hobbing time from 9 to 4-1/2 minutes per load of two pulleys. One machine now does the work of 4 previous machines. 3,000 pieces per hob sharpening are obtained using .045" feed per revolution of the work and 137 rpm hob speed.

Change to *Multithread* Hobs Reduces Cutting Time From 26 to 10 Minutes. Adjacent Tooth Spacing Held to .0004"

● Accurate tooth spacing within .0004" adjacent is maintained and hobbing time has been reduced more than half by changing to *Multithread* hobs on this 141-Tooth helical gear job. The accuracy of the No. 16-16 hobbing machine at high production is evident in the lead error per tooth held within .0008" over entire 7/8" face width. Gears are hobbed 2 per load, at .069" feed per revolution and 128 rpm hob speed.

COMPLETE GEAR HOBBING SERVICE

BARBER COLMAN

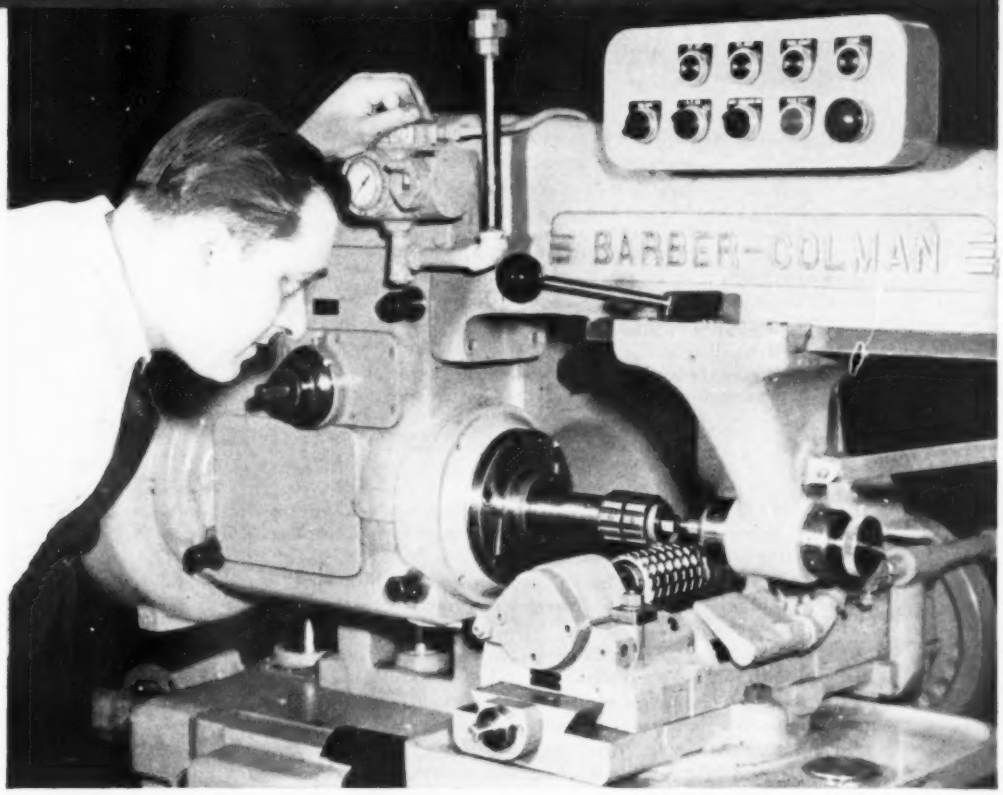
HOBS • MACHINES • SHARPENING • TECHNICAL DATA

BUILDERS OF PRECISION GEAR

Barber-Colman

No. 16-16 Hobbing Machine

CUTS HOBBING TIME IN HALF



● These jobs are typical of the production experience obtained by users of No. 16-16 Hobbing Machines in cutting higher quality gears *with greatly reduced machining time* . . . Recognized for its consistent accuracy under high production operation, the No. 16-16 Hobbing Machine is being used constantly for new and different operations, where precision form limits are required. This splined pulley job is an example. The more conventional intermediate gear operation shows the dependability for producing tooth accuracy at constant high production rates.

Ask your Barber-Colman representative about other new applications, proving similar production advantages.

Barber-Colman Company

GENERAL OFFICES AND PLANT, 118 ROCK STREET, ROCKFORD, ILLINOIS, U. S. A.

HOBS AND MACHINES SINCE 1911

Introducing ...

The New Forging

HIGH SPEED FORGING MAXIPRESSES are making an ever-growing percentage of the world's forgings. Their advantages over old-fashioned equipment include:

1. **Low operator skill requirement**
2. **High production and die life**
3. **Low installation and maintenance costs**
4. **Quiet operation and freedom from vibration**

MAXIPRESSES have won acceptance as the *preferred* high speed forging presses for these reasons:

1. **Rigidity of construction**
2. **Reliability in operation**
3. **National's leadership in engineering applications**
4. **National's dependable service performance**

The new MAXIPRES brings to industry *23 distinctly new forging press features* . . . establishing new high standards of forging press performance! Among these new features are:

BRAKE: **The old band-type brake has been replaced by a completely new water-cooled diaphragm disc brake. Provides extremely accurate stopping with negligible maintenance.**

ECCENTRIC: **Much greater in diameter and width. Bearing area and overall shaft strength now 30% greater.**

CLUTCH: **New trouble-free clutch with increased ruggedness and ability, fewer parts and indestructible driving keys.**

TONNAGE INDICATOR: **Takes guesswork out of estimating forging loads. Dial reads directly in tons, immediately indicating overload. Device prolongs life of press, reduces maintenance, speeds set up, rates jobs for the correct size MAXIPRES, and permits forging to closer tolerances.**

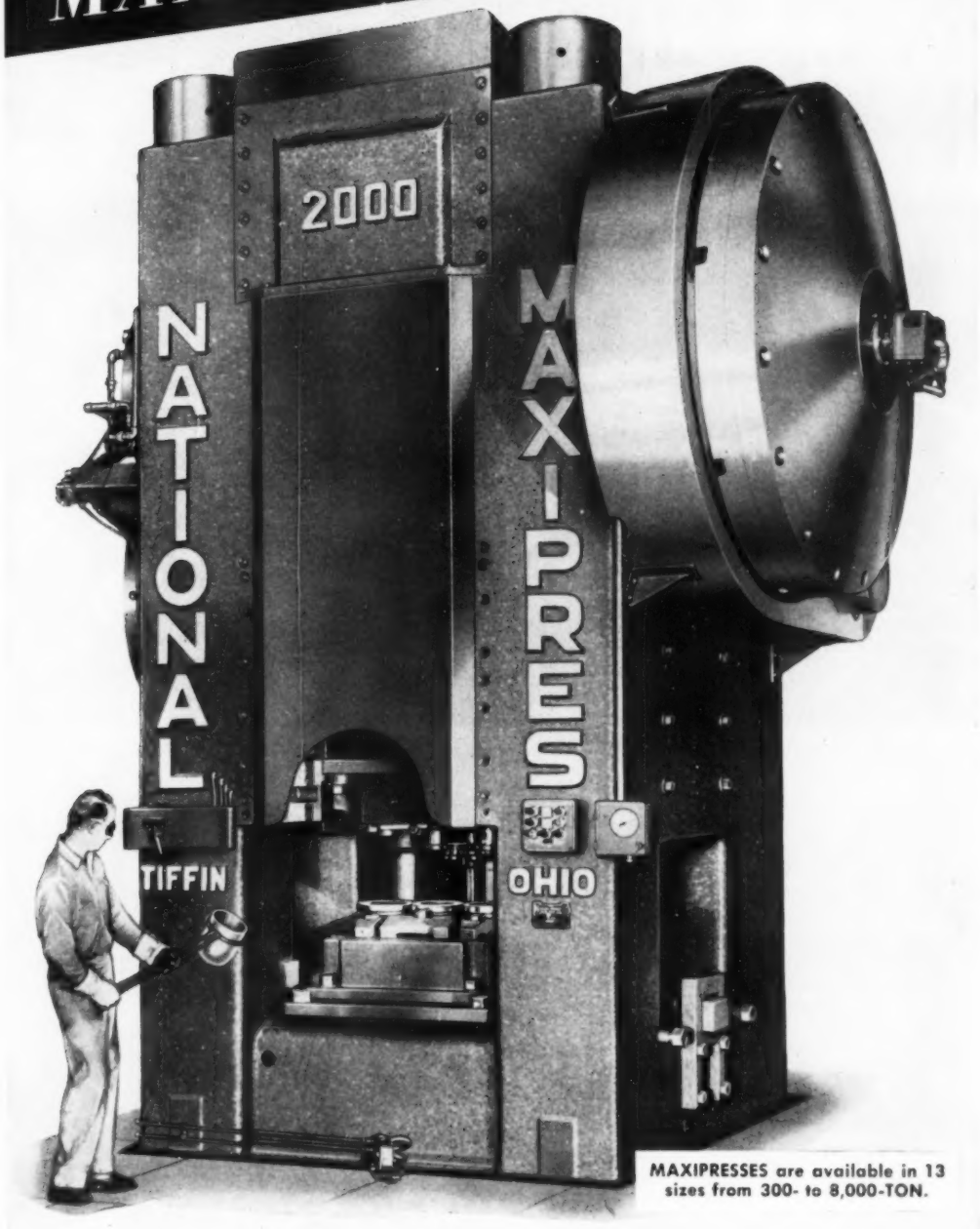
Additional particularly significant advancements have been engineered into the bedframe, pitman, wristpin, main bearings, counterbalance cylinders, air controls and wedge construction. The new MAXIPRES, designed for the times, fulfills the expanding requirements of the fast-moving forging industry.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET, AND WIRE NAIL MACHINERY

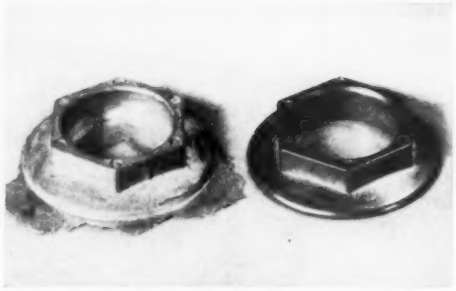
Hartford **Detroit** **Chicago**

MAXIPRES!



MAXIPRESSES are available in 13 sizes from 300- to 8,000-TON.

What Does Barrel-Finishing With ALUNDUM* TUMBLING ABRASIVE Offer You?



Typical die casting before and after tumbling with ALUNDUM Tumbling Abrasive.

A variety of parts before and after barrel-finishing with ALUNDUM Tumbling Abrasive. Included are castings, forgings, stampings, and machined parts.

- It provides you with a fast, clean, economical method for finishing your metal parts to exact dimensions and degrees of surface finish.

- It enables you to remove burrs, flash, tool marks, and heat scale from large quantities of stampings, die castings, and forgings quickly and inexpensively.

- It eliminates many slow hand-finishing operations, increases production, saves time and money.

- If you don't have barrel-finishing equipment in your plant, Norton will make test runs for you, without obligation, to show you what this process with ALUNDUM Tumbling Abrasive can do for you.

A Tip on Barrel-Finishing

Don't forget that oily parts should be thoroughly cleaned before barrel-finishing. They retard the abrasive action and make it impossible to obtain bright finishes.

Norton Booklet, Form 301, "Precision Tumbling with Alundum Abrasive" is packed with useful information. Write for your free copy.

NORTON COMPANY
Worcester 6, Mass.

Distributors In All Principal Cities

NORTON
ABRASIVES
Making better products to make other products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

"AMERICAN"
HYDRAULIC DUPLICATOR

The Latest COST CUTTING Sensation

Here's a job that's being done in 34 minutes, floor to floor. This includes a finishing cut to reduce grinding time to a minimum. It formerly took 76 minutes to turn and 50% longer to grind.

This marvelous machine will reproduce steps, tapers, right angle and tapered shoulders, recesses, grinding necks and radii and is especially adapted to the production of such work as spindles, motor shafts, valve stems, back shafts, piston rods and axles. It will also accommodate a wide variety of chuck work having irregular contours.

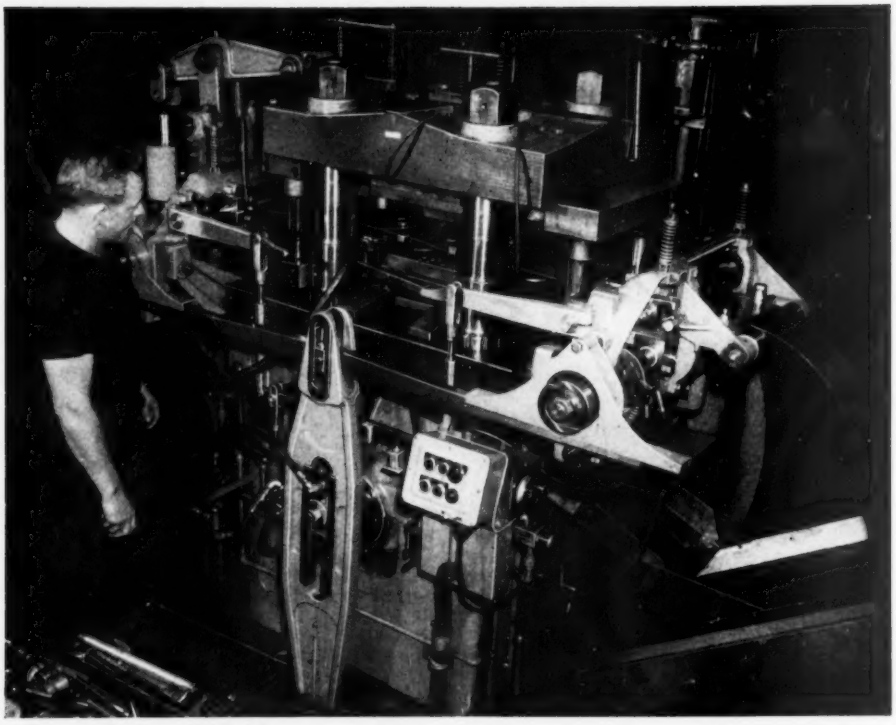
A single hydraulic system is employed for operating the hydraulic tracer valve and the piston which controls the movement of the tool slide carrying the cutting tool. This simplicity is an outstanding feature and insures accurate reproduction, freedom from failures and elimination of work rejects. This new metal cutting technique permits continuous cutting without interruption for measuring or calipering at feeds and speeds to the cutting limit of Cemented Carbide tools. "Miking" on shaft work is confined to the first diameter only after which all other diameters are secured automatically.

This machine may be quickly converted to standard lathe operations.

Descriptive Bulletin No. 35
sent upon request

THE AMERICAN TOOL WORKS CO.
Cincinnati, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



For The Oldberg Manufacturing Company*

which uses Henry & Wright Dieing Machines to produce muffler parts such as oval outerheads, oval innerheads, three-pass innerheads and cones. Oldberg, like other leading companies who know the score, rely on Henry & Wright Dieing Machines to slam a cover on rising production costs. These compact, precise, metal-fabricating wonder workers swing at costs with a two-fisted attack. And what a licking these costs take. They just can't stand up to the one-two combination of high speed and long die life delivered by Henry & Wright machines.

*Subsidiary of The AP Parts Corporation, Toledo, Ohio, manufacturers of: Mufflers, Pipes, Miracle Power, DGF 123.

Only the best is

OTHER EMHART PRODUCTS INCLUDE:

GLASS MAKING MACHINES

HARTFORD-EMPIRE CO.
Division of Emhart Mfg. Co.
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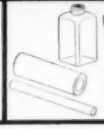
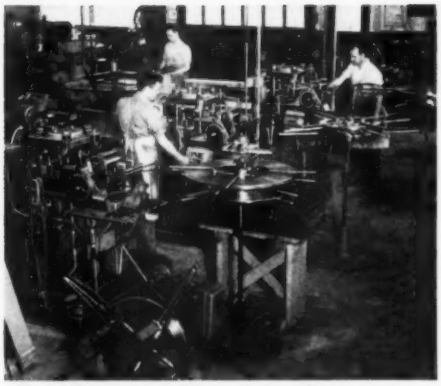
AUTOMATIC PACKAGING EQUIPMENT

STANDARD-KNAPP
Division of Emhart Mfg. Co.
PORTLAND, CONNECTICUT



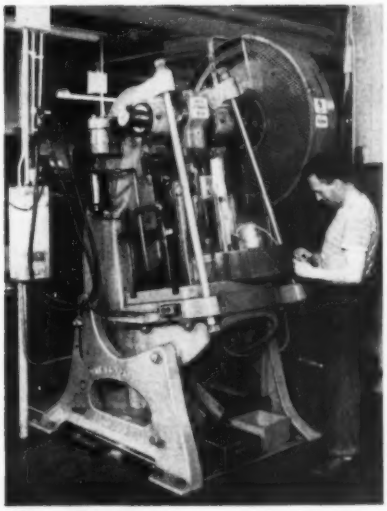
PLASTIC BOTTLES, RODS, TUBES, SPECIAL SHAPES

PLAX CORPORATION
Subsidiary of Emhart Mfg. Co.
HARTFORD 1, CONNECTICUT



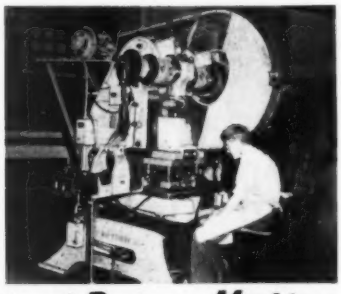
For Barber-Colman Company

where Henry & Wright Dieing Machines are "an important contributor to the production of many of our products, particularly our Uni-flo Air Distribution Outlets." Above 25-ton units are piercing, folding and cutting off strips of grill material to predetermined lengths.



For Gillette

where 10-, 25-, and 50-ton V & O presses are used. Above 50-ton machine forms the cap for the Gillette one-piece razor at production rates of approximately 4,000 parts per hour. Engineered for close tolerance work, V & O presses are preferred by companies making precision-built products.



For International Business Machines

which uses V & O presses for numerous precision parts. The above V & O press is producing an armature for relay assembly out of coiled, cold-rolled electrical iron. Five working stations are used. The part is trimmed, pierced with two holes, finish blanked, and offset at one end. In the final working position, two ears are bent up and a second offset is formed.

H&W

HENRY & WRIGHT
DIVISION OF EMHART MFG. CO.

good enough

V&O

THE V & O PRESS CO.
DIVISION OF EMHART MFG. CO.

FACT PACKED CATALOGS

Catalogs containing complete specifications and operating details are available. Please write The V & O Press Company, Hudson, N. Y.

Complete descriptions of all Henry & Wright Dieing Machines. Write: Henry & Wright, 483 Windsor St., Hartford, Conn.

NOW! stainless cast fittings from CRUCIBLE STEEL!

Stainless cast fittings . . . such as made for Alloy Stainless Products Company, Paterson, N. J. . . . shown above . . . are being produced for Industry at Crucible's Specialty Steel Foundry—Harrison, New Jersey. These fittings find ideal application in such diversified activities as: Atomic Energy Commission; Chemical, Oil, Pharmaceutical, Textile Industries.

Pioneer in the development of stainless steels, Crucible is casting these high quality fittings in Types 304, 316 and 347 stainless. Made under the most exacting metallurgical supervision and radiographic control, these castings are entirely free of porosity, internal shrinkage, or other casting defects. The castings are furnished annealed, blast cleaned and passivated for maximum corrosion resistance.

The high casting quality plus the particularly husky design make the Alloy Stainless Products' pipe fittings among the leaders in the field.

In addition to stainless cast fittings, tool steel and alloy steel castings are made at the Crucible foundry to meet the requirements of hundreds of Industrial applications. And remember too, our metallurgical staff is freely available to you. If you have a need for castings—check with Crucible.

CRUCIBLE first name in special purpose steels

51 years of Fine steelmaking

STAINLESS CASTINGS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Why Gisholt's Recommendations Are Unbiased. In helping you solve your turning problems, Gisholt engineers have no reason to favor one type of machine over another except on the basis of its ability to best serve your needs. For Gisholt manufactures both manually operated turret lathes and automatic lathes.

C/F TURRET LATHE HANDLES AWKWARD PART

Face Plate Fixture Economical For Small Lots

The irregular shape of these bar feed bodies presents quite a chucking problem. That, combined with small lot production, means you have a real problem. We are solving this problem right in our own shop by putting the job on a 5L Saddle Type Turret Lathe.

A special face plate fixture is mounted on the face of the 32" Gisholt scroll chuck. This is counterweighted to permit using higher spindle speeds. The part is quickly bolted to the fixture and rigidly held for multiple boring, counterboring and facing operations. At the completion of the first operation, the part is removed, a spacer added to the fixture, the part is turned over, and second operation work is performed. The cost of the fixture is more than made up by the rapid handling of the job.

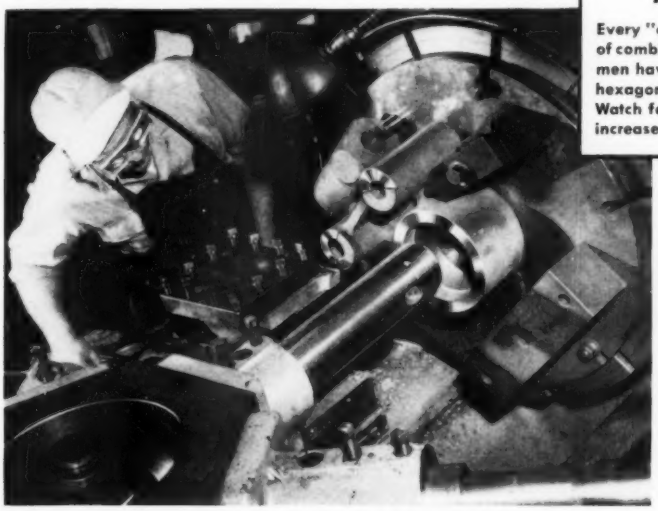
Cross Feeding Turret Helps Simplify Job

Turret tooling is kept to an absolute minimum. A single tool bit in the square turret handles facing of the hub and intermittent facing cuts. A single boring bar in the cross feeding hexagon turret handles the rough and finish cuts in the bore and counterbores. Thus, simplified tooling keeps down the investment and reduces the setup time. Further savings are made possible because the rigid construction of the machine permits simultaneous use of the square and hexagon turrets.

Simple tooling, plus simultaneous machining from both turrets and a counterweighted face plate, results in maximum efficiency.

Are you missing a bet?

Every "old-timer" in your shop knows the value of combined cuts on a turret lathe. But, many new men have not learned to save time by using the hexagon and square turrets at the same time. Watch for this in your shop . . . it will help you increase production.



This close-up shows how a smart setup can make a fast, easy job out of an otherwise slow and awkward one. Note the special counterweighted face plate.

Machined part after boring and facing the diameters and support bearing surfaces.

New literature describing the 5L Saddle Type Turret Lathe is now available.

A GOOD WAY TO MACHINE PULLEYS

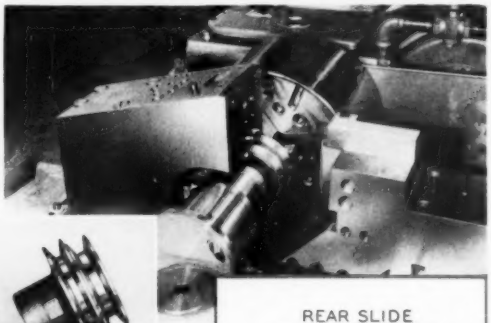
From Rough Casting to Finished 2-Step Pulley in 1.2 Minutes

Suppose you got a large order for two-step pulleys like these. How would you handle the job?

This manufacturer does it right . . . on a Gisholt No. 12 Hydraulic Automatic Lathe. The 5" parts are held in a simple 3-jaw air chuck. An air-operated tailstock supports the piece under the heavy cuts.

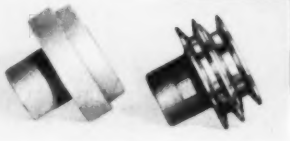
On the front carriage you have a special combination tool block with two turning tools mounted above the work and five grooving and facing tools conventionally placed at the side. On the rear slide you have a skiving tool mounted underneath the work and a form tool on centers. Here is the cycle:

1. **Front carriage feeds to the left and turns the two diameters with overhead tools.**
2. **Feed changes from longitudinal to cross feed, and the lower tools rough out the grooves and straddle-face both ends.**



This No. 12 Hydraulic with 5 sets of tools completes 2-step pulley every 1.2 minutes.

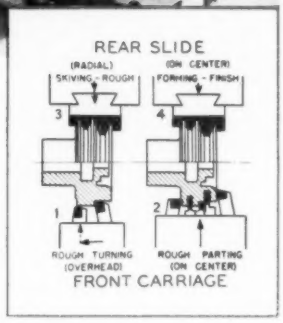
Rough casting and finished pulley.



3. **Rear slide brings in skiving tool to rough form the grooves. Tools are below the centerline and pass beyond after completing their work.**
4. **Forming tools feed in on the centerline to finish the job.**

Entire operation takes 1.2 minutes, floor to floor.

Multiple cuts with four sets of tools provide fast, automatic production at minimum cost.



Drawing shows 4 sets of tools that do entire pulley machining job.

DELICATE PARTS GET GENTLE TREATMENT FROM RAM TYPE TURRET LATHE

Special Tooling Simplifies Machining of Cream Separator Bowls

Here a Gisholt Ram Type Turret Lathe has the rather tricky job of machining the tubular shaft and base for cream separator bowls.

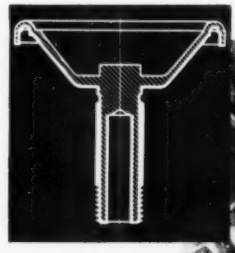
Support for the long and rather weak stem is provided by a roller rest turner mounted on the hexagon turret. On the third turret face is an adjustable head with four tools for machining the several surfaces at the bottom of the conical base.

Single Point Tool Generates Angle

The conical surface is nicely handled with a special angular mounted tool slide on the back of the square turret cross slide. Because this surface is too wide, and because the material is rather difficult to form or shave with a single broad tool, this angle is generated with a single point tool. The photo shows how it's done at the same time the drill does the center hole. There is a pusher plate on the face of the drill holder which, as the hexagon turret advances, contacts the roller on the angular slide and pushes this along to turn the cone at the same time.

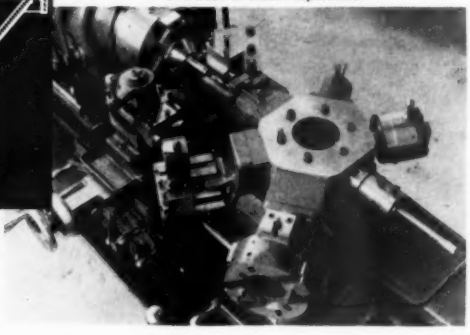
The square turret has a special multiple tool block with two tools (instead of the usual one), to face the end of the stem and the flat surface at the base of the stem.

Special tools on the hexagon turret and square turret combine to achieve a maximum number of cuts with a minimum number of approaches to the work.



(Above) The heavy lines show the many machining operations on these parts for cream separators.

Tooling on Gisholt Ram Type Lathe for machining tubular shaft and base of cream separators.



GISHOLT

TIME-SAVING IDEAS

A SMART SETUP FOR HYDRAULIC VALVE BODIES

Minimum Changeover on Fastermatic

Perhaps you can use an idea like this: an automatic turret lathe set up to handle four different sizes of valve bodies, requiring only such minor changes as spacers in the holding fixtures, individual drills, boring bars, etc. The machine is a Gisholt 1F Fastermatic Automatic Turret Lathe.

The work itself is simple enough. It begins with a boring bar that sizes the cored hole in the casting—just deep enough to give the core drill a true start. The core drill is followed in order by counterboring, chamfering, finish boring and facing.

Fastermatic set up for finishing valve bodies. Note completed part on machine at right.

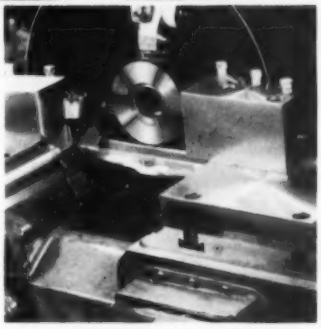
Tool Relief Provided

A conventional boring bar does the finish boring. When the cut is completed, a stop bar and cam move the entire bar toward the spindle centerline so it may be withdrawn without leaving a "snake track."

The tool blocks of the independent front and rear cross slides have adjustable slide tops and are fitted with T-slot mounting bases. The rear slide, which does the finish facing, is equipped with hydraulic tool relief. At the completion of the cut, the slide tips away from the work several thousandths to permit the tool to clear the work as the slide is retracted.

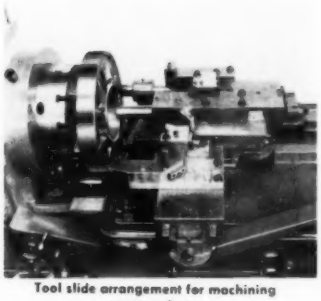
All operations in machining these valve bodies are performed automatically by the Fastermatic. It's the ideal way to handle such work—with *one* operator able to handle two or more machines. Catalog on request.

The Fastermatic handles a number of rough and finish cuts in one chucking and allows simple changes for difficult sizes—all with a standard automatic cycle and with tool relief where needed.



Close-up of rear slide equipped with hydraulic tool relief for clearing work after facing.

HERE'S THE RIGHT COMBINATION FOR FASTER FINISHING OF DIFFERENTIAL CARRIERS



Tool slide arrangement for machining gear carriers.

Simplimatic Brings More Tools to Bear on Work

The photo shows second operations on a differential carrier—the kind of job that's a "natural" for this Simplimatic Automatic Lathe.

The wide platen accommodates individual tool slides with each slide feeding in the desired direction and at its own rate of feed. This permits each of the required number of cuts to be made in the most advantageous manner. The operations here are: turning the O.D., straddle facing both sides of the rim, facing and counterboring the hub, and at the same time finishing the radius or spherical bore in the center with a swinging tool actuated from the front tool slide.

The large platen table permits a choice of slide arrangements so each tool can work to best advantage. This makes it the equivalent of a "Special" machine designed for high production work.

GISHOLT

MEASURES AND CORRECTS UNBALANCE IN COMPLETE CRANKSHAFT ASSEMBLIES

TIME-SAVING IDEAS

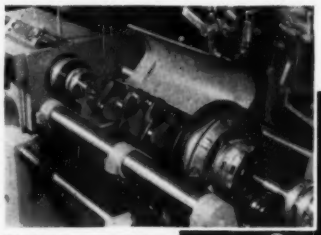
Gisholt Balancer Combines Two Types of Correction Equipment

Here is the way crankshaft assemblies are balanced by one large automobile manufacturer. A type "S" Double End Drive Balancing Machine locates and measures dynamic unbalance in two parts of the assemblies—and then proceeds to make correction by two *different* methods.

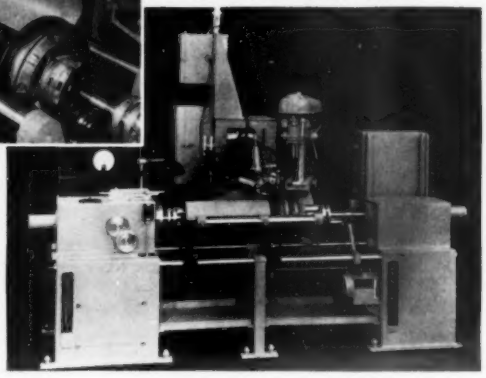
When correction is made on the fluid coupling, weight is *added* to the light side of the part. This is done by welding a slug of the proper weight (as indicated by the machine) to the light side by means of welding equipment mounted on the back of the machine.

In correcting unbalance in the clutch, weight is *removed* from the heavy side of the part. A drill press for this operation is also mounted on the balancing machine.

This machine illustrates again how Gisholt balancing equipment is adaptable for virtually every balancing problem. There's full information on balancing in the booklet, *Balancing Machines.* Write for it.



A crankshaft assembly ready for balancing.



Type "S" Balancing Machine equipped with welder and drill press for two methods of correction on crankshaft assemblies.

GISHOLT Balancing School

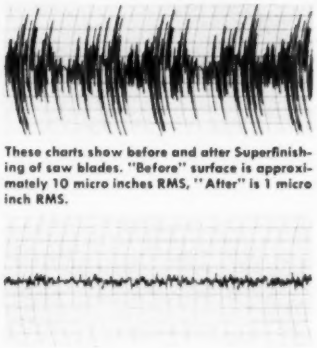
Complete courses are now offered, covering the theory and practical applications of balancing to help you with your problems. Write for details. Type "S" course starts Sept. 10.

With special correction equipment this machine locates, measures and corrects unbalance—all without removing workpiece from machine.

DYNETRIC BALANCERS

SLITTER SAWS—BEFORE AND AFTER SUPERFINISHING!

Saw Blade Life Increased Six Times by Superfinishing



These charts show before and after Superfinishing of saw blades. "Before" surface is approximately 10 micro inches RMS, "After" is 1 micro inch RMS.

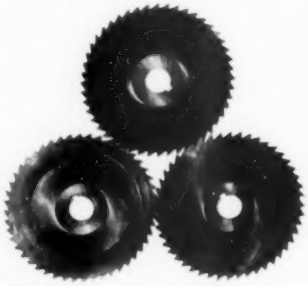
These two charts show the amazing difference in surface finish of slitter saw blades before and after Superfinishing.

"Before" shows how the blades formerly were used in our shop. This way, however, the blades had a tendency to pick up material and bind. This galling shortened the useful life of the blade and caused rejects.

Now, all blades are Superfinished. From an average surface finish of 10 micro inches RMS, both sides are Superfinished down to 1 micro inch RMS. This results in *six times longer blade life*—offsetting many times the cost of Superfinishing. Binding is greatly lessened. There's less scoring trouble.

This rather unusual use of Superfinishing shows the wide application of this modern process. Write for your copy of *Wear and Surface Finish.*

Superfinishing greatly extends the life of saw blades, reduces binding and scoring, pays real dividends.



Note lack of striations on Superfinished surface of top blade. Lower right shows blade *not* Superfinished and, lower left, what happens to this blade in service.

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

No. 851
575

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

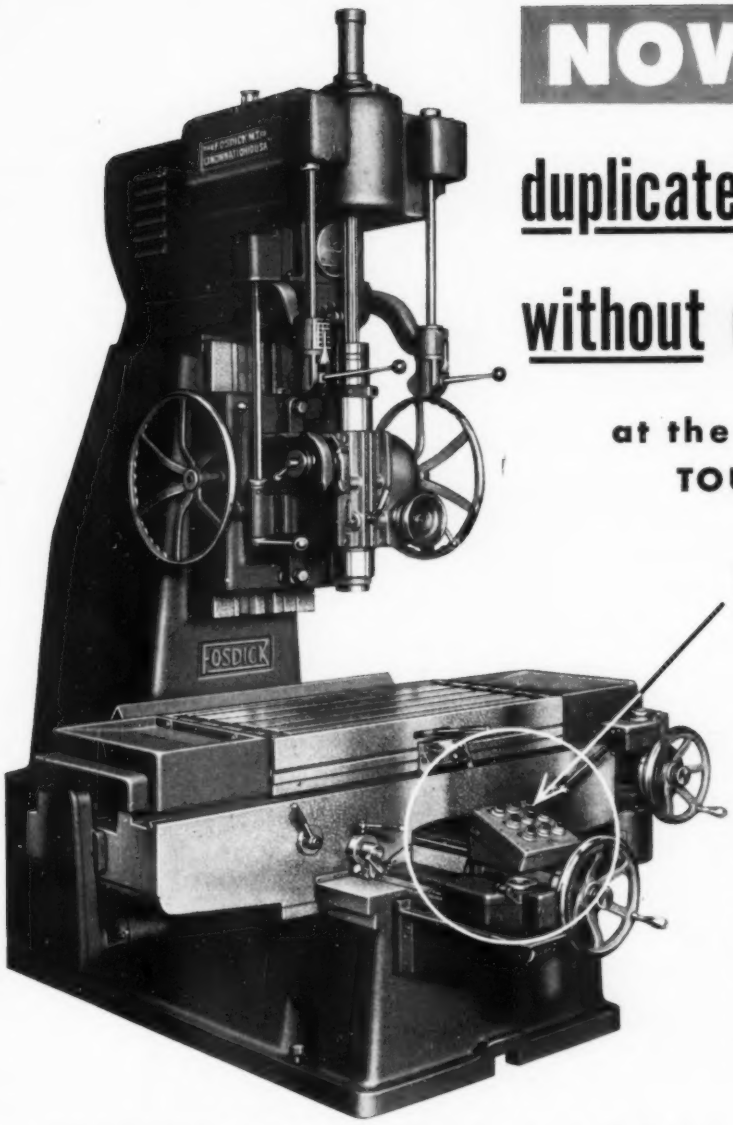
A general catalog on machines listed below is available on request.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

NOW...

duplicate parts without costly jigs

at the TOUCH of a BUTTON



For exact reproduction of drilled, bored and tapped parts — *weeks, months* or *years* apart — install a Fosdick Automatic Positioning Machine. This new machine tool eliminates costly jigs, makes possible accurate part duplication with holes located to tolerances as close as ±.0001", by means of duplicating bars. You can make these bars quickly, store them in your tool crib.

Only two duplicating bars are required for each job — one for the table, one for the cross slide. They're made of standard ¾" bar stock, drilled for each hole to be produced in the work. Once the bars are set and the work initially positioned, the operator simply presses a button — rapid traverse motors take over, and in seconds the work is ready for the next operation.

A new Fosdick Automatic Positioning Machine in your shop will pay for itself many times over through savings in man-hours, set up time, materials and storage space. For more information write today for Bulletin JBA.

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK

Designed for making fast work of slow jobs

THE NEW BRITAIN MACHINE COMPANY

AUTOMATIC BAR AND CHUCKING MACHINES • PRECISION BORING MACHINES

LUCAS HORIZONTAL BORING DRILLING AND MILLING MACHINES

NEW BRITAIN

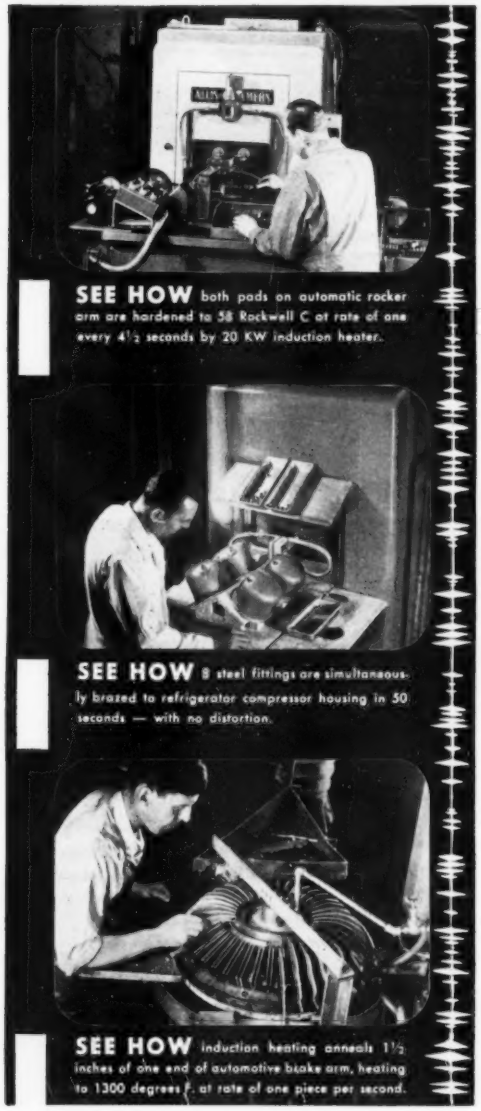
Automatics

THE NEW BRITAIN GRIDLEY MACHINE DIVISION
THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT

New Film Shows How

INDUCTION HEATING INCREASES PRODUCTION

Now you can see on-the-job applications showing how products are improved, costs cut



SEE HOW both pads on automatic rocker arm are hardened to 58 Rockwell C at rate of one every 4½ seconds by 20 KW induction heater.

SEE HOW 8 steel fittings are simultaneously brazed to refrigerator compressor housing in 30 seconds — with no distortion.

SEE HOW induction heating anneals 1½ inches of one end of automotive brake arm, heating to 1300 degrees F. at rate of one piece per second.

FOR IDEAS on how you can improve your product while increasing production and cutting costs at the same time, you'll want to see this new movie. It shows how induction heating saves time and money in annealing, hardening, brazing, or soldering.

When you see this 20 minute 16 mm. color-sound movie, you'll find out how an automotive manufacturer annealing brake arms achieves an amazing production record of 3600 parts per hour. And how induction heating permits local heating of only the section to be annealed, speeding production and eliminating work hardening and cracking.

You'll see how a manufacturer of baby carriages solves a problem of heat loss and scale on a metal part with induction heating. And how production was increased with a heating cycle of only 50 seconds.

You'll see how a textile machine manufacturer hardens 2240 trimmer blades an hour — an increase in production of 300 percent over the old method!

You'll see many more interesting and informative case histories showing why up-to-date production men are selecting induction heating to handle many different types of heating operations.

You can arrange for a free showing of this entertaining and informative film, which is titled, "Industrial Heating, Industry's Modern Tool," by filling out the coupon below. If you'd like a copy of the booklet explaining the story of induction heating as told in the film, check the lower box in the coupon. Find out how induction heating can help you. Send the coupon today!

A-3432

ALLIS-CHALMERS

See How to Speed

ANNEALING • BRAZING
HARDENING • SOLDERING

ALLIS-CHALMERS, 999A SO. 70 ST.
MILWAUKEE, WIS.

☐ **Please send print of 16 mm. color-sound film "Induction Heating, Industry's Modern Tool."**

☐ **Please send me booklet describing induction heating movie.**

Name ..... Title .....

Firm ..... Address .....

City ..... State .....

HERE'S HOW TO
CUT ELECTRODE WASTE

Good Technique and the Right Rod for the Job Reduce Electrode Waste up to 40%

You can deposit more weld metal, in less time and avoid wasting electrodes by using approved techniques, the right electrode for the job, and by following the manufacturer's recommendations. G-E electrodes give you high deposition rates, meet AWS specifications, and are available in a wide variety of sizes and types.

Get 40 percent more from your electrodes today by:

1. **Avoiding bending whenever possible**
2. **Using electrodes down to a 2-inch stub**
3. **Providing better "fit-ups"**
4. **Protecting welding rods through better storage and care**
5. **Laying flat-face fillets on vertical fillet welds**
6. **Making fillet legs of equal length on horizontal fillets**

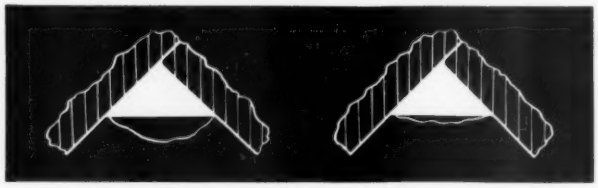
Check your horizontal and vertical fillet-welds against the illustrations on the right. Watch for future hints on improved welding techniques.

Accurate Measurement of Weldments Is Easy with this Gage

Check welds with this corrosion-resisting, stainless steel fillet-weld gage. It is a necessary tool for providing a quick, easy, accurate means of gaging fillets having either straight, concave, or convex contours of the following sizes: ¼ in., ⅜ in., 7/16 in., ½ in., ⅝ in., and ½ in. Easy to carry, it comes complete in a leather case.

Get yours today from your nearest G-E Welding Distributor. He can give you additional hints on how to get the most from your electrodes and equipment. You can find his name in the yellow pages of your telephone directory. Look for "General Electric" under "Welding Equipment."
General Electric Company, Schenectady 5, N. Y.

ON VERTICAL FILLETS



WASTE

On vertical fillets, you may be wasting as much as 40 percent of your weld metal. A poor contour, as shown above, may be due to one or more of the following conditions:

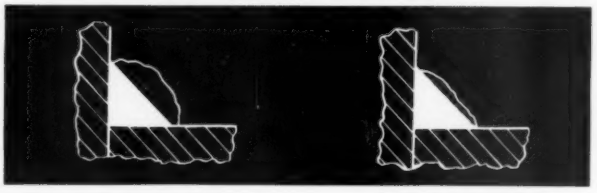
- **Arc length too short**
- **Electrode too large**
- **Forward travel speed too slow**
- **Excess whipping**
- **Excessive current. Metal runs out**
- **Wrong electrode for the job**

GOOD PRACTICE

You can prevent this needless waste of electrode by putting into practice one or more of the following suggestions:

- **Use welding current recommended by the electrode manufacturer**
- **Use as large an electrode as plate thickness will allow, but not larger than 7/16 inch in diameter**
- **Increase travel speed**
- **Change to electrode better suited for this type of joint**

ON HORIZONTAL FILLETS



WASTE

On horizontal fillets, you may be wasting as much as 30 percent of your weld metal. A poor contour may be due to one or more of the following conditions:

- **Electrode held at wrong angle**
- **Electrode too small for size of fillet**
- **Excess current, metal runs down**
- **Arc length too short, causing overlap**
- **Forward travel speed too slow**
- **Wrong electrode for this type of joint**

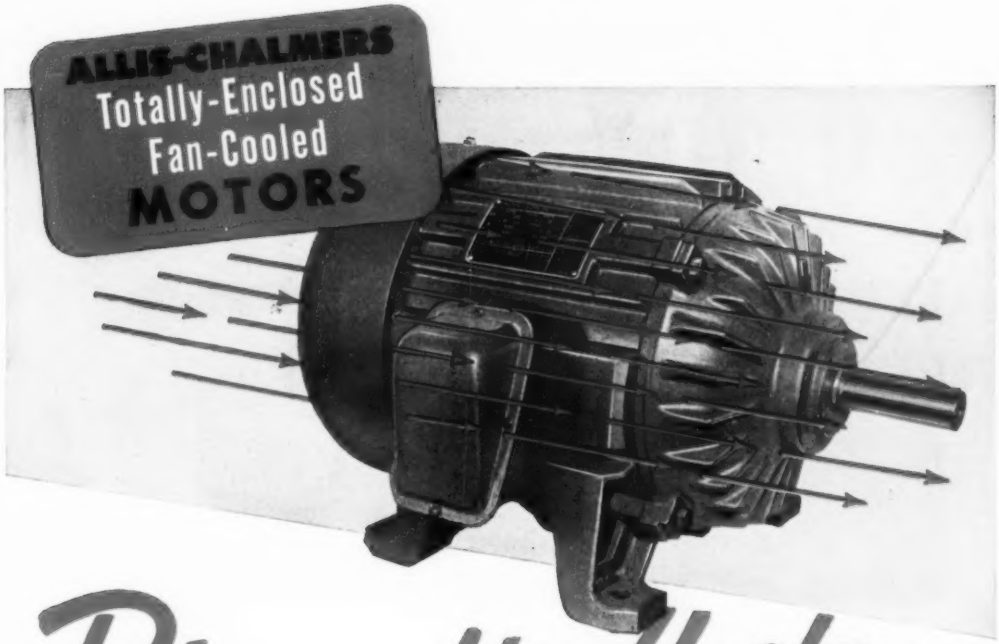
GOOD PRACTICE

You can prevent this needless waste of electrode by putting into practice one or more of the following suggestions:

- **Hold electrode at proper angle**
- **Use as large an electrode as possible**
- **Use welding current recommended by the electrode manufacturer**
- **Increase travel speed**
- **Use proper electrode for this type of joint**

712-6

GENERAL ELECTRIC



Blows itself clean as a Whistle!

DIRT IS CARRIED AWAY by cooling air blown over the ribbed cast iron frame and bearing housings of this new Allis-Chalmers tefc motor. That means less motor cleaning . . . inspection . . . overhaul!

Concealed air passages and pockets have been eliminated. Dirt can't build up to cause overheating. And as for oily dirt that sticks — just wipe or blow it off.

Studies show that on most applications, totally-enclosed fan-cooled motors more than pay back their extra cost in reduced maintenance. And this new Allis-Chalmers Type APZ tefc motor makes maintenance costs lower than ever before.

Rigid Construction

The frame is cast iron which has high resistance against corrosion and distortion. Bearings are pre-lubricated at the factory and should need no attention for years. Tapped holes with pipe plugs to permit regreasing and to provide grease relief are standard equipment.

Get All The Facts

The new Allis-Chalmers Type APZ totally-enclosed fan-cooled motor is built in all NEMA standard frame sizes from 224* to 505. Also in explosion-proof type. Your A-C Authorized Distributor or District Office has complete information. Call today, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B7225.

A-2427

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

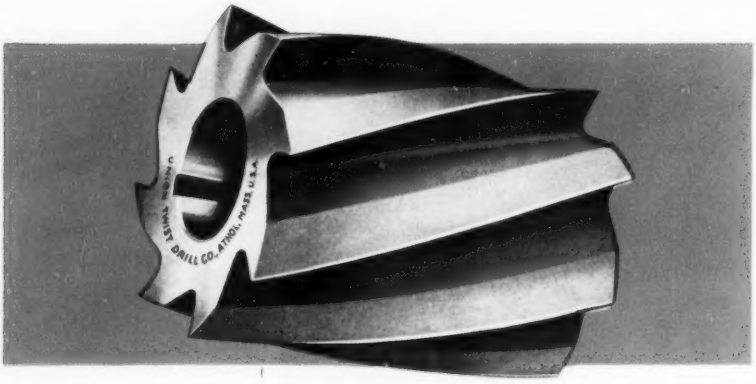
PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

*Similar design non-ventilated motors Type APK, also available in frames 203 to 224 inclusive.

You cut downtime, increase output with UNION *Profile Cutters*



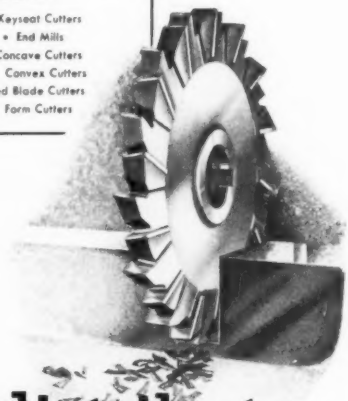
You can depend on a *minimum* downtime for reconditioning when you use Union high speed steel heavy duty profile cutters. Their undercut teeth have a special spiral angle that assures unusual efficiency and permits resharpening without rapid increase in width of land. Note the wide spacing, too. It allows ample chip room, and makes possible exceptionally strong teeth. Because there are fewer teeth in contact with the work, you also save on power.

Union profile cutters are performance proved. Rely on them for the toughest jobs in the shop. They work to closest tolerances, produce outstanding results from old or new machines. Available in 12 sizes ranging from 2½" to 4½" diameter.

A MILLING CUTTER FOR EVERY JOB

Whether you need special cutters built to your specifications or can use the standard Union cutters, there's a Union milling cutter to meet your needs. Following is a partial list —

Plain Milling Cutters • Keyseat Cutters
Helical Milling Cutters • End Mills
Metal Slitting Saws • Concave Cutters
Screw Slotting Cutters • Convex Cutters
Slitting Shears • Inserted Blade Cutters
Side Milling Cutters • Form Cutters



no other profile cutter will outperform a UNION

contact your local distributor

His name is listed in Union's THOMAS' REGISTER insert under "Drills, Twist".

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

Milling Cutters · Gear Cutters · Twist Drills · Hobs · Reamers · Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass. Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers . . . BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.

Greater production... *it's in the CARDS!*

Whether your parts are ferrous, non-ferrous or non-metallic — if they require flat surfaces, the chances are that a Blanchard can grind them faster, better and cheaper than by any other machining method.

The Blanchard No. 18 will hog off stock from rough castings — *or* produce surfaces flat to one light band with finishes of one micro-inch!

Most jobs require no holding fixtures, and many jobs with surfaces of varying heights may be handled on the magnetic chuck with simple steel blocks. For help in obtaining the accurate production of your own parts, write for the two free catalogs shown below.

All work done on a NO. 18 BLANCHARD with 36" chuck.

Send for your free copies of "Work Done on the Blanchard," fourth edition, and "Art of Blanchard Surface Grinding."

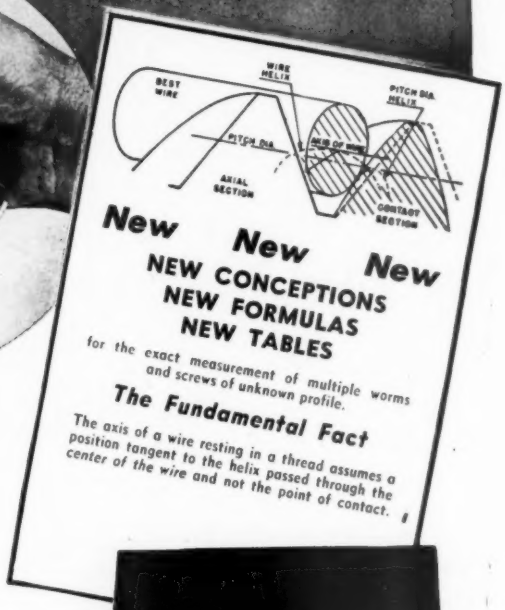
PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE CO.
64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

Van Keuren MEASURING WIRES

STANDARD EQUIPMENT... ...everywhere

Measuring the pitch diameter of a 1"-8 National Form thread gage. This method is recommended by the Bureau of Standards.



New New New

NEW CONCEPTIONS
NEW FORMULAS
NEW TABLES

for the exact measurement of multiple worms and screws of unknown profile.

The Fundamental Fact

The axis of a wire resting in a thread assumes a position tangent to the helix passed through the center of the wire and not the point of contact.

Van Keuren Measuring Wires are the accepted standard equipment for making pitch diameter measurements of taps, thread gages, precision threaded parts, hobs, worms, splines and gears. Reputable manufacturers of ground taps and thread gages used for the production and acceptance of threaded holes and nuts use Van Keuren Measuring Wires. You will seldom find them in error if you, too, have Van Keuren Measuring Wires.

Catalog and Handbook No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies free upon request.

Set No. 20 Thread Measuring Wires is a plant necessity for maintaining taps and thread gages within their limits for wear and for proving the pitch diameter of screws and threaded parts.

Price, High Speed Steel Wires $115.00
Price, Carboloy Wires 450.00

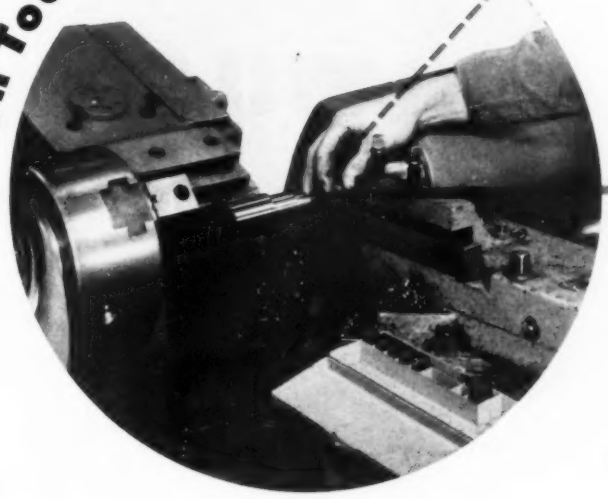
Special wires from .002" to 2.000" diameter are made to any tolerance required.

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

32nd YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

How to STOP the CLOCK on Tool Change Time



You can change Indexible Insert Tools on the Monarch Mona-Matic in *Just 8 Seconds Flat!*

MONARCH INSERT TOOL KIT, with tool holder and 9 inserts, each with 3 cutting edges on each end. These 54 cutting edges can be identically reground by merely squaring end and grinding chip breaker if desired. Cuts tool costs and tool change time to a fraction.

THE FAMOUS MONARCH MONA-MATIC—the ultimate for production turning operations. Let us prove with actual job performance reports, how it outperforms ordinary multiple tool machining methods.

Contrast this procedure with the conventional solid tool change! Don't touch the tool holder adjustment. Take a turn on the clamp screw—lift out the indexible insert, revolve it on its axis and replace it—tighten the same screw. *That's it!* You haven't changed your tool setting in any way. You don't need any trial cuts—any new miking of the job—any resetting of the tool. Just start removing metal where you left off.

Here's the simplest and quickest tool change found on *any* production turning equipment. Applying it to the Monarch Mona-Matic is almost like gilding the lily. Even with conventional solid tools, this high-output production lathe can show you truly amazing results in increased production, lower tool costs, shortened setup time and subsequent grinding time. We mean BIG results, which we will gladly substantiate with job data. And with insert tools, the Mona-Matic's even better!

Just one more minute! You're always reading ads that say "Write for details." This time, *do it* (requesting Booklet 1804)—and enjoy the inevitable result in your future operating statements . . . *The Monarch Machine Tool Co., Sidney, Ohio.*

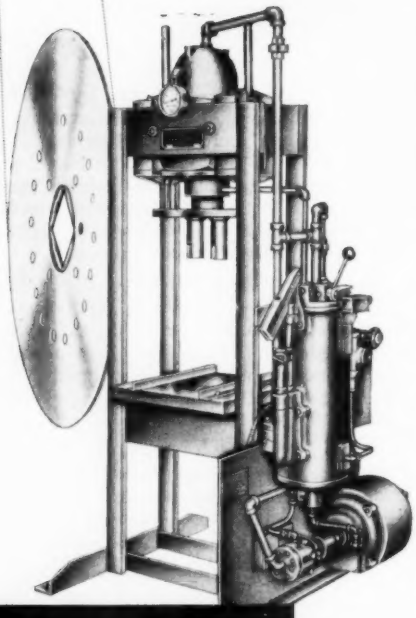
FOR A GOOD TURN FASTER—TURN TO MONARCH

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

K·R·WILSON goes bob-bob-bobbin along



KRW HYDRAULIC PRESSES DO UNUSUAL JOB FOR AMERICAN LACE INDUSTRY

Compressing 90-180 yards of lace thread on a bobbin 3/64" thick. That's the job KRW presses do for the American lace industry. Using a new bobbin pressure device, designed by our good customer, Kent County Machine Co., 480 bobbins are pressed at one time. The average lace machine has 4400 of these bobbins working at once, so it takes 9 precision set-ups to do a complete set. This new process is 8 times faster than older methods and over 80% of the lace thread used by the industry is now compressed this way on KRW presses. Each wound bobbin measures 1/32" thick . . . precision work with a capital KRW.

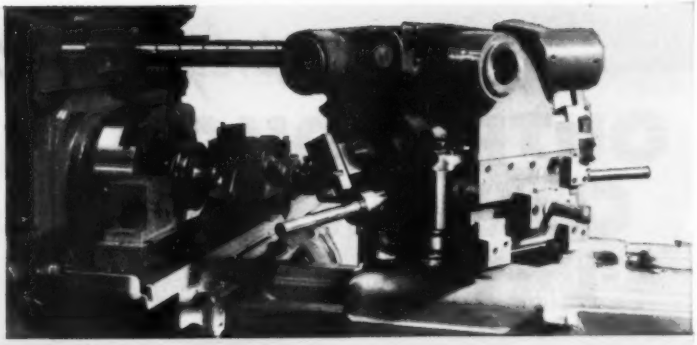
Any precision press problems in your operation? Check with KRW. We have a complete line of low-cost, money-saving Hydraulic presses. Capacities from 25-150 tons. Hand-operated, air-operated or motor driven. If you need a specially built press, we'll engineer one to your specifications.

Ask your Machinery dealer to quote prices.
Or write or wire Dept. 11.

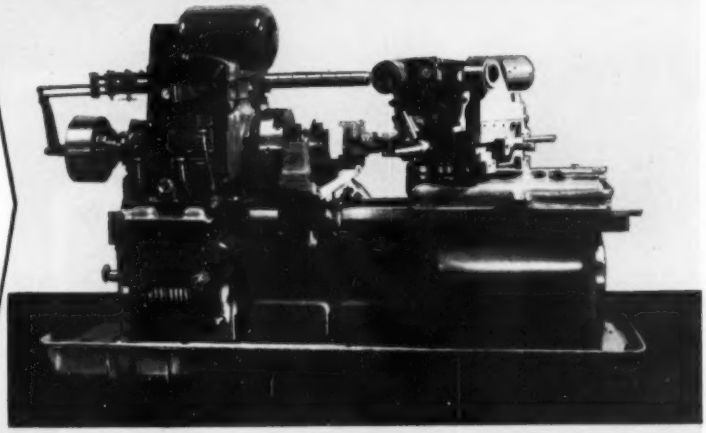
K·R·WILSON

215 MAIN ST. BUFFALO 3, N. Y.

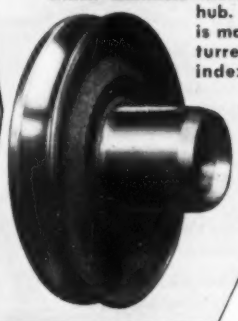
THIS KIND OF
PRODUCTION TOOLING



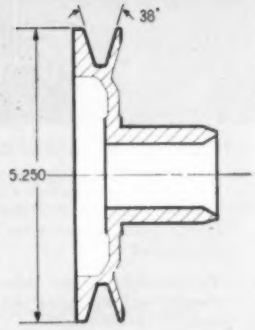
ON THE
POTTER & JOHNSTON 5D AUTOMATIC



TURNS OUT THIS CLASS OF WORK
FASTER–BETTER
and with
FEWER REJECTS



P&J-designed Tungsten Carbide Tooling does a speedier job of rough-machining and precision-finishing all the surfaces indicated by heavy lines in this Pulley drawing. Note the ingenious Slide Tool which chamfers the inner end of the hub. The outer bevel is machined when the turret automatically indexes to the next position. This single P&J Tooling set-up turns out better than 10 Pulleys per hour at 85% efficiency on the P&J 5D AUTOMATIC.



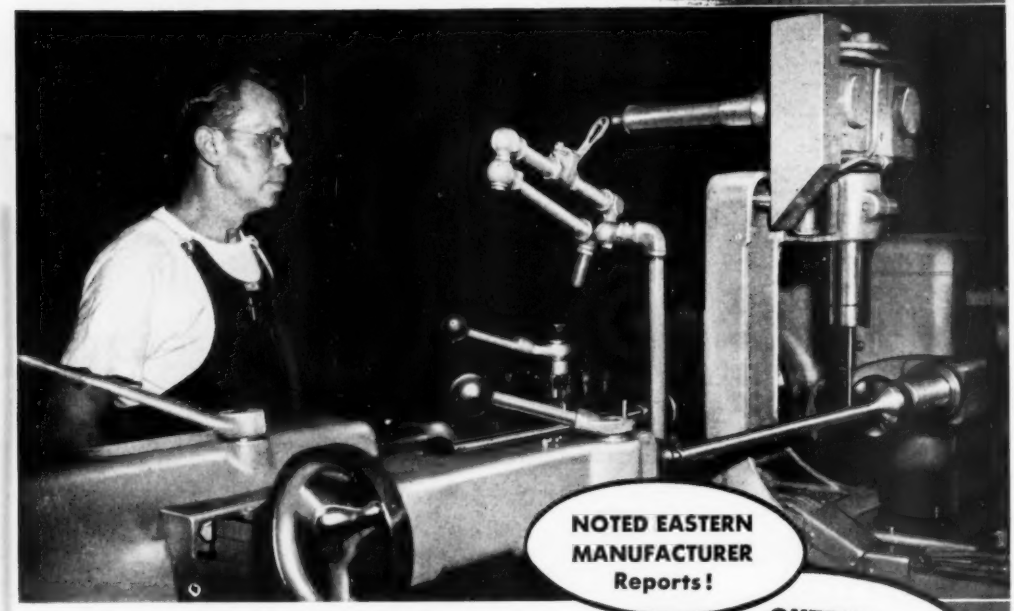
Numerous similar examples of P&J Precision Tooling on P&J AUTOMATICS are shown in this free Booklet, "Productivity with Economy." Write for your copy.

POTTER & JOHNSTON CO.
PAWTUCKET, R. I.
subsidiary of PRATT & WHITNEY
Division Niles-Bement-Pond Company

Lodge and Shipley COPYMATIC

OUTPRODUCES CONVENTIONAL LATHE

3 to 1



NOTED EASTERN MANUFACTURER Reports!

"... more pleased than we had hoped," says this COPYMATIC user, noted makers of compressors, engines, pneumatic tools, hoists and pumps. Former production was 5 pieces per hour—with the COPYMATIC, production rose to 15 pieces per hour. By combining three operations and eliminating the human element, production is increased 200%.

This production-rated lathe gives you the added advantage of instant changeover from engine lathe to automatic duplication without the high cost of a special machine.

In the illustration, gas engine valves of forged Silchrome XB steel treated to Rockwell C27-32 are being turned at .004" per rev. feed, 270 FPM speed.

The COPYMATIC can give you, too, increased defense production with important savings in time, money, floor space, manpower and less capital investment. Investigate now. Write for Bulletin 675.

OUTPUT... "Increased 200%"

VERSATILITY... "One of chief reasons it was bought"

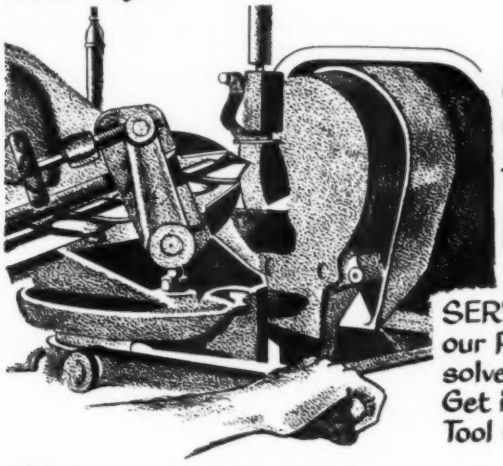
ACCURACY... "Very good"

DESIGN FEATURES... "Especially like totally-enclosed quick-change gear box"

THE **Lodge & Shipley** COMPANY
MACHINE TOOL DIVISION • 3059 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

DRILLING POINTERS..... by Red Shield

OVERHEATING. 5/32" jobbers' drills on automotive job were burning and dulling rapidly. We gave them drills with different heat treatment and showed them how to point drills correctly. Now last much longer.



CHIPPING. 3/8" jobbers' drills on plastic part caused chipping. We suggested Standard No. 504 B. Plastic Type Drill and showed them how to point. Now holes are clean. Drills have longer life.

SERVICE. 70 years' experience behind our Red Shield Service Staff... to help solve your metal cutting problems. Get in touch with your local Standard Tool Co. distributor.

STANDARD TOOL CO. DEPT. 3-A, 3950 CHESTER AVENUE CLEVELAND 14, OHIO

New York • Detroit • Chicago • San Francisco

THE STANDARD LINE: *Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools*

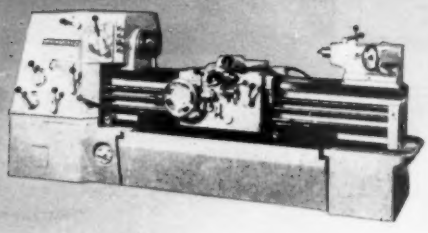
REPLACE With SPRINGFIELD

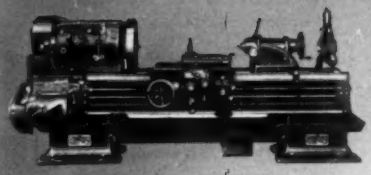
LATHES

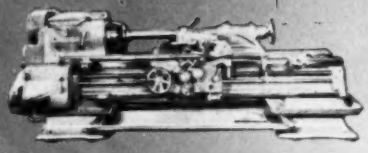
handle a wider range of work—

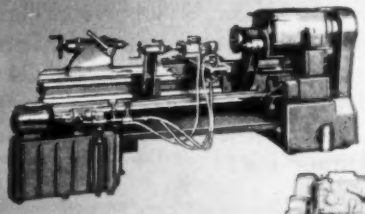
increase output—

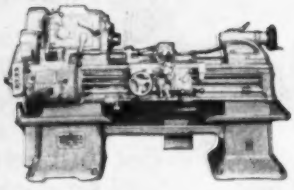
lower operating costs











TURNING
CONTOURING
PROFILING
ENGRAVING
REPRODUCING
BORING
THREAD CHASING
RELIEVING

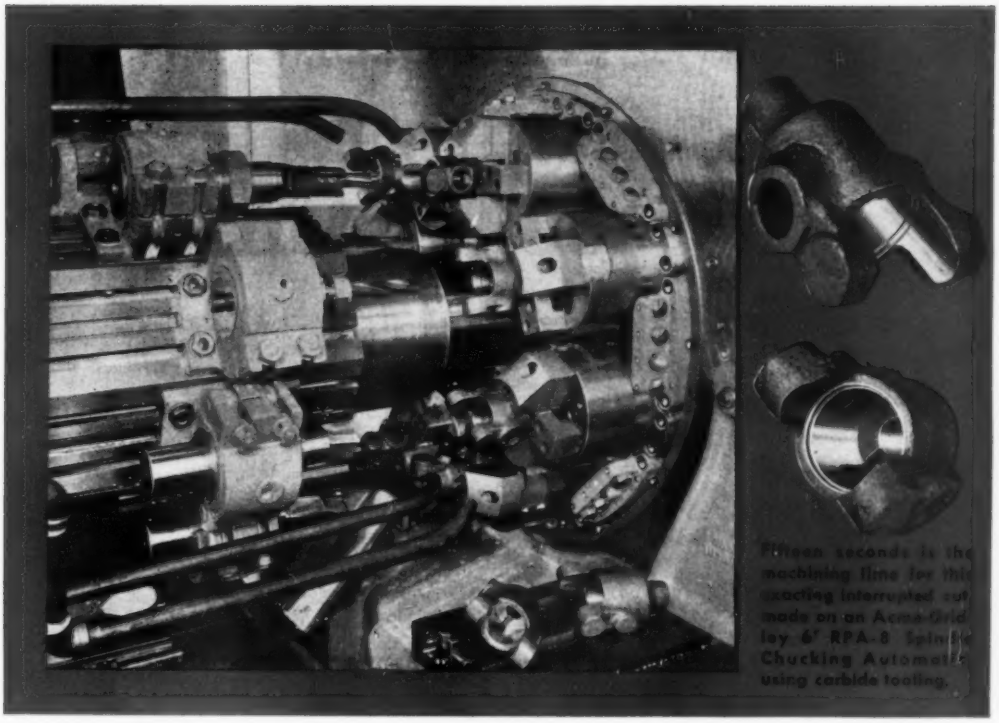
14" to 32" sizes for heavy manufacturing operations or sensitive tool room work

THE SPRINGFIELD MACHINE TOOL COMPANY

SPRINGFIELD, OHIO, U. S. A.

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities



Fifteen seconds is the machining time for this exacting interrupted cut made on an Acme-Gridley 6" RPA-8 Spindle Chucking Automatic using carbide tooling.

HOLD HIGH CONCENTRICITY on high-speed interrupted cuts

...put the job on an Acme-Gridley Automatic

Here's more proof that an Acme-Gridley's basic design advantages pay off in the ability to take it—on the toughest kind of tricky jobs—up to the limitations of modern carbide tooling speeds.

To take interrupted cuts at high speed and still maintain concentricity, an automatic must have rigid, rugged strength in the frame; *an Acme-Gridley's got it.* And direct, positive camming keeps accuracy always up to snuff.

Adaptability is another important advantage of Acme-Gridleys; they'll handle a wide variety of tooling (including independent power-driven auxiliaries where needed). That way, better distribution of cuts or the combining of operations can cut machining and handling times.

All these features add up to give you "more good pieces in the pan," more tough production problems licked. Get the full story on these time-saving, money-saving Acme-Gridley 4, 6 and 8 spindle Chucking Automatics—ask for Bulletin CM 51.

JOB FACTS

PART—Hydraulic Lift Box

MATERIAL—1035 Steel Casting

MACHINE—Acme-Gridley 6" RPA-8 Spindle Chucking Automatic

TOOLING—Carbide

TOLERANCES—.003" on Large Hole; .001" on Small Hole

MACHINING TIME—15 Seconds (240 hr.)

Machine Obsolescence is the Creeping Paralysis That Strangles Profit.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog-Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

fine tools that promote consistent accuracy

Even the most highly skilled machinist finds it easier to maintain high production with consistent accuracy when equipped with quality tools. The added assurance which they afford permits faster precision work with less fatigue.

Brown & Sharpe supplies a complete line of Machinists' Tools that represent the fullest measure of sound design, precision manufacture and proven reliability. They are universally recognized by machinists as the criterion of quality tools.

Write for complete small tools catalog.

Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

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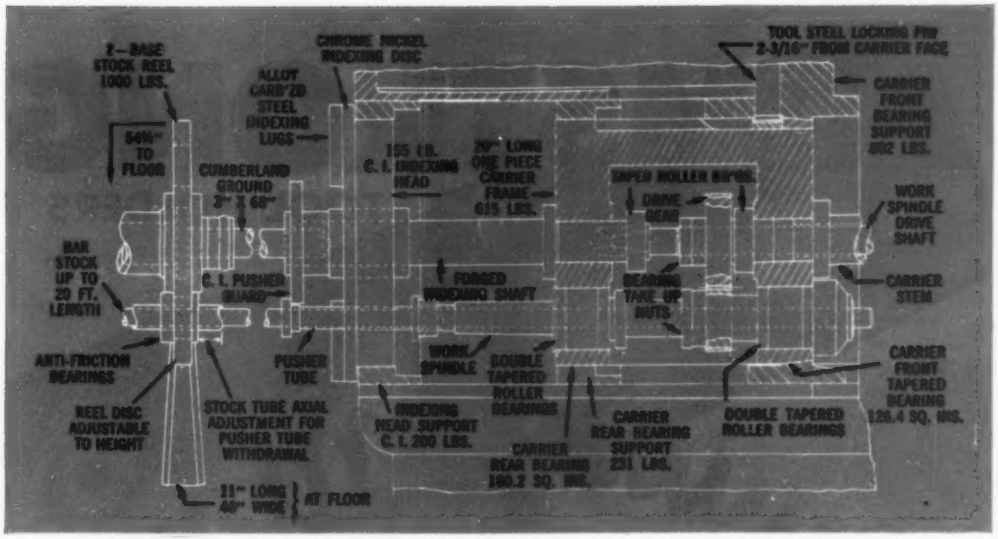

2—BASE STOCK REEL 1000 LBS.
CHROME NICKEL INDEXING DISC
TOOL STEEL LOCKING PIN 2-3/16" FROM CARRIER FACE
ALLOY CARB'ZD STEEL INDEXING LUGS
CARRIER FRONT BEARING SUPPORT 802 LBS.
54½" TO FLOOR
155 LB. C. I. INDEXING HEAD
20" LONG ONE PIECE CARRIER FRAME 615 LBS.
CUMBERLAND GROUND 3" X 60"
TAPER ROLLER BRGS.
DRIVE GEAR
WORK SPINDLE DRIVE SHAFT
BAR STOCK UP TO 20 FT. LENGTH
C. I. PUSHER GUARD
FORGED INDEXING SHAFT
BEARING TAKE UP NUTS
CARRIER STEM
ANTI-FRICTION BEARINGS
PUSHER TUBE
WORK SPINDLE
DOUBLE TAPERED ROLLER BEARINGS
CARRIER FRONT TAPERED BEARING 126.4 SQ. INS.
REEL DISC ADJUSTABLE TO HEIGHT
STOCK TUBE AXIAL ADJUSTMENT FOR PUSHER TUBE WITHDRAWAL
INDEXING HEAD SUPPORT C. I. 200 LBS.
CARRIER REAR BEARING 180.2 SQ. INS.
CARRIER REAR BEARING SUPPORT 231 LBS.
DOUBLE TAPERED ROLLER BEARINGS
21" LONG 40" WIDE AT FLOOR

FIRST THINGS COME FIRST

Upon the Spindle Carrier of an "Automatic" falls the responsibility of accurately presenting and holding the work to — and in contact with — the tools. The basic design of the Carrier is obviously of first importance in the protection of the work spindles from the strain of heavy cuts and weight of the bar stock. Then, in proportion to the Carrier's ability to handle the full load is the importance of any supplementary facility that shares the load.

1. **The 1½" Six Spindle CONOMATIC CARRIER gives better support to the work spindles under heavy loads.**

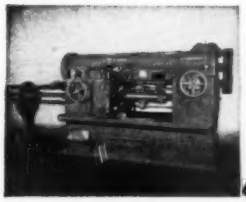
The thick, heavy ribs resist strain. The tapered front bearing and the spindle drive gears are within 3" and 9¼", respectively, of the collet faces. The wider spaced bearings give better alignment and load distribution. The Carrier is free of Cross Slide positive stop pressure.

2. **The entire INDEXING MECHANISM is supported by the Top Bed as well as the Base. There are fewer wearing parts.**

The Indexing Head takes the brunt of the indexing load. It is supported by the short frame member midway between the Carrier and the Stock Reel. It is joined to the latter by strong center shafts.

3. **The STOCK REEL is designed to handle longer and heavier loads.**

The two Stock Reel Bases are independent of the machine and relieve it of the heaviest part of the bar load during the cutting and indexing movements. Adjustable alignment gives freer stock-feed action.



Buyer's Comparison Chart will guide you to full information

A Comparison of ALL Automatics is in Favor of Cone

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

ARMSTRONG
TOOL HOLDERS

Equip with
ARMSTRONG TOOL HOLDERS
for Defense production

A change over to new products, starts in the tool room and the die shop . . . starts with ARMSTRONG TOOL HOLDERS. In preparing for defense orders, the logical first step is to check your stock of ARMSTRONG TOOL HOLDERS. With the correct types for every operation, and the correct sizes for each lathe, planer, slotter and shaper, you will be able to start work on a moments notice.

ARMSTRONG TOOL HOLDERS reduce "tooling-up" to the selection of a cutter and tightening of a set screw. They permit operation at higher speeds, and heavier feeds than are customary—they enable you to produce more pieces per hour, per man, per machine.

Produced by modern methods, in a specially-built tool plant, they are the lowest cost tooling you can buy. And, they are as available as your telephone for they are carried in stock by your local supply house.

Use ARMSTRONG TOOL HOLDERS wherever possible for lower tool cost, saving in High Speed Steel, increased output and greater profit. *Write for Catalog*

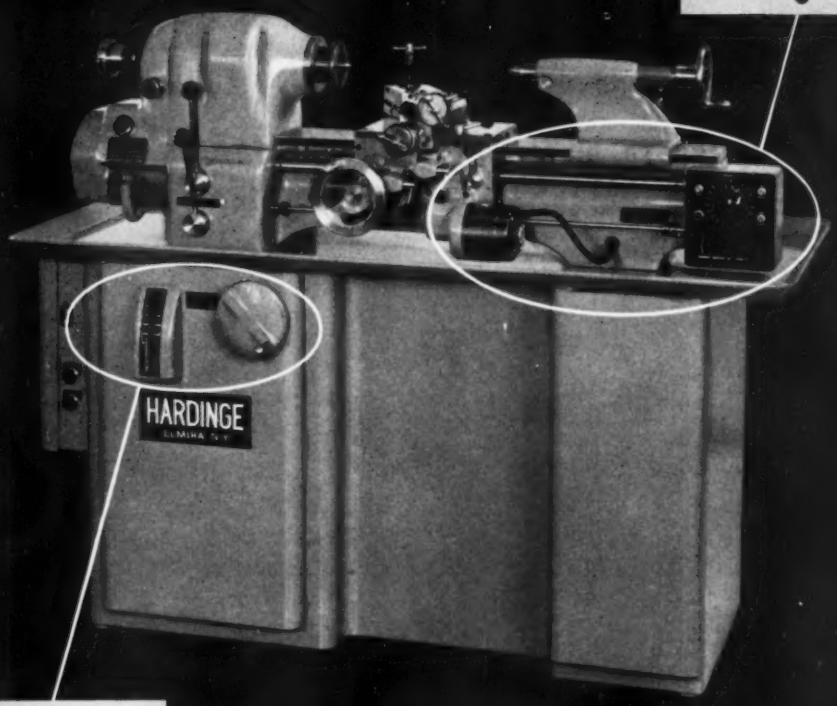
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"
5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

Infinite Control of Speed and Feed

is a feature of the HARDINGE ELMIRA, N.Y.

Tool Room and Production Lathe



Both drives are independent and infinitely variable to secure every possible combination of speeds and feeds within the following range:

Variable Speeds: 125 to 3100 r.p.m.

Variable Feeds: ¼" to 7" per minute

Write HARDINGE *for Bulletin HLV*

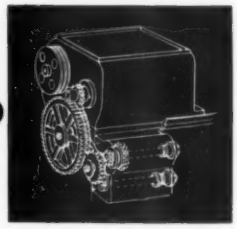
HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

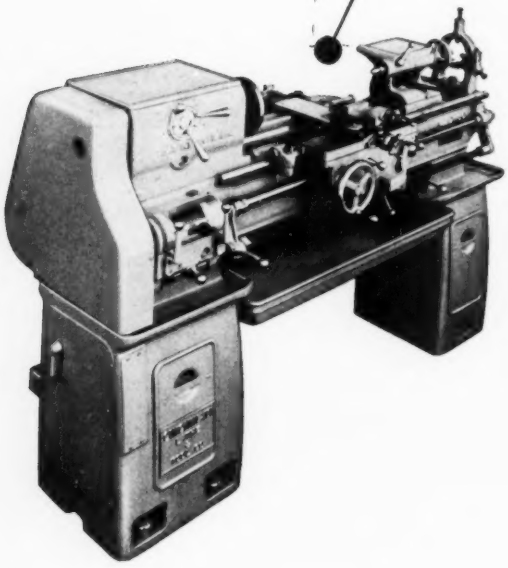
quick change artist

Reposition just 3 parts

Set up only two additional gears



from English to metric thread-chasing in about ten minutes*



Simple straightforward steps arrange your Tray-Top light duty engine lathe to cut a full range of 48 metric threads and carriage feeds through the standard quick change box . . . quicker by far than for any other lathe, and more economical, too . . . What's more, you can change any of 12 spindle speeds (all geared, 40 to 1 overall ratio) in an instant, with 3-lever direct-reading color-match speed selector . . . And you can change setups because parking spaces on top of headstock and tailstock put mikes, tools, etc., at operator's fingertips, right where needed.

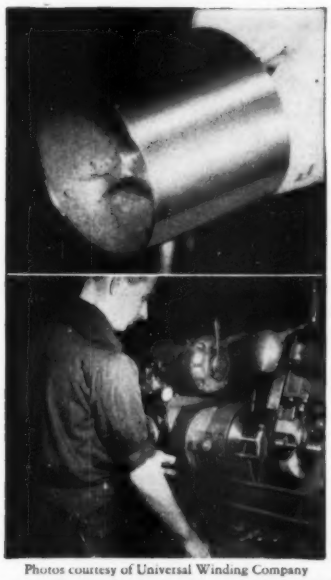
Your Tray-Tops are indeed quick change artists. Operators spend no time figuring, more time getting work out. Make your next light duty lathe a Tray-Top.

required for many defense items.

CINTILATHE

OF OUTSTANDING VALUE

CINCINNATI 9, OHIO, U.S.A. **cincinnati lathe & tool co.**



Photos courtesy of Universal Winding Company

Smooth as silk...to protect nylon

Because delicate nylon must pass over these rolls without danger of damaging rips—the stainless steel surface must be ground to the smoothest of finishes.

Universal Grinding Company reports that V11 Bond grinding wheels are perfect for the job because of excellent form holding qualities at reduced grinding pressures.

Cool, free cutting action produces superior finishes to close tolerances; more rapid stock removal results in high production rate.

Why not investigate the advantages of V11 Bond Wheels by CARBORUNDUM in your cylindrical grinding operations? See your local CARBORUNDUM salesman or distributor—or write Dept. AM 81-27.

Only **CARBORUNDUM**
TRADE MARK

makes ALL Abrasive Products ...to give you the proper ONE

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, N.Y.

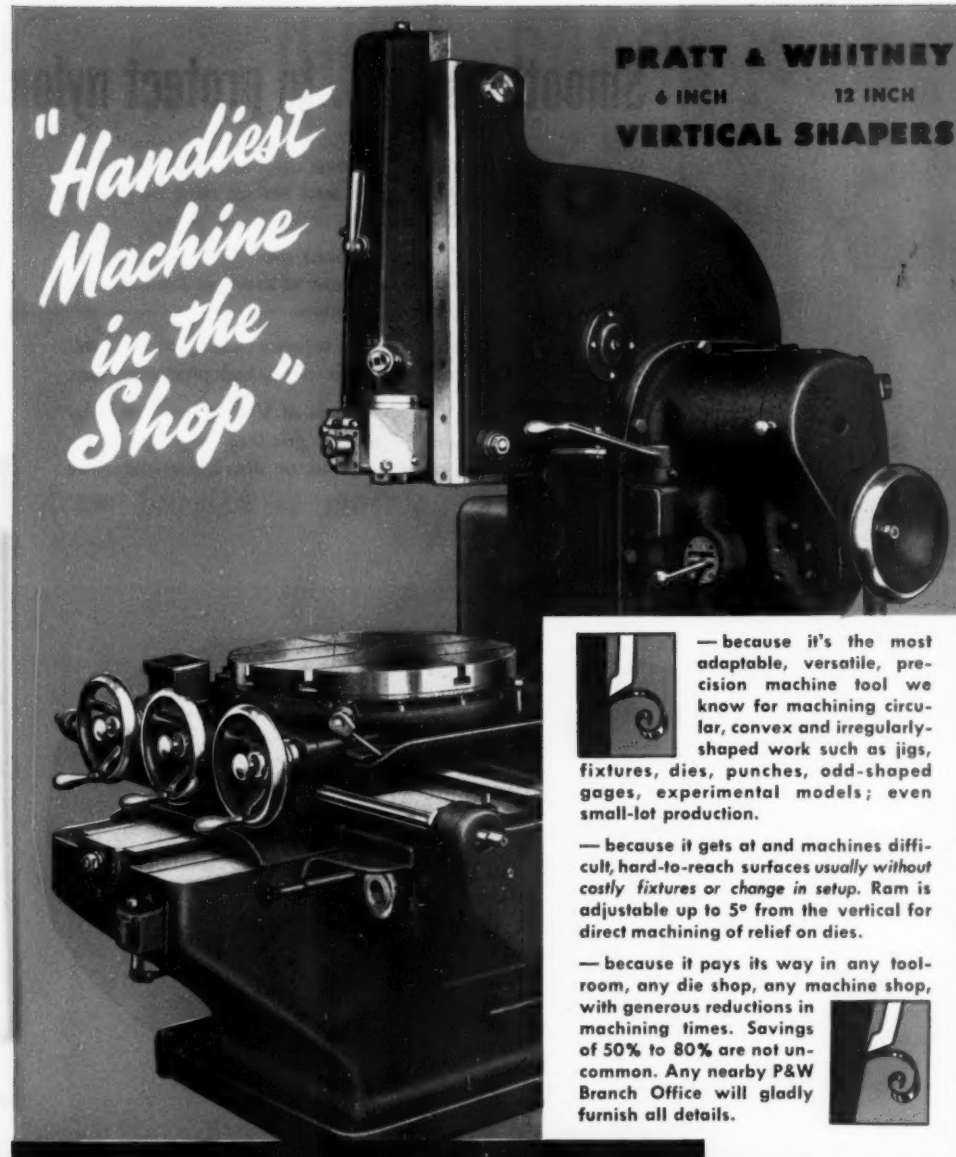
81-27

"Handiest Machine in the Shop"

PRATT & WHITNEY

6 INCH 12 INCH

VERTICAL SHAPERS



— because it's the most adaptable, versatile, precision machine tool we know for machining circular, convex and irregularly-shaped work such as jigs, fixtures, dies, punches, odd-shaped gages, experimental models; even small-lot production.

— because it gets at and machines difficult, hard-to-reach surfaces *usually without costly fixtures or change in setup.* Ram is adjustable up to 5° from the vertical for direct machining of relief on dies.

— because it pays its way in any toolroom, any die shop, any machine shop, with generous reductions in machining times. Savings of 50% to 80% are not uncommon. Any nearby P&W Branch Office will gladly furnish all details.

PRATT & WHITNEY

Division NILES-BEMENT-POND COMPANY

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Dedicated to Accuracy for 91 years

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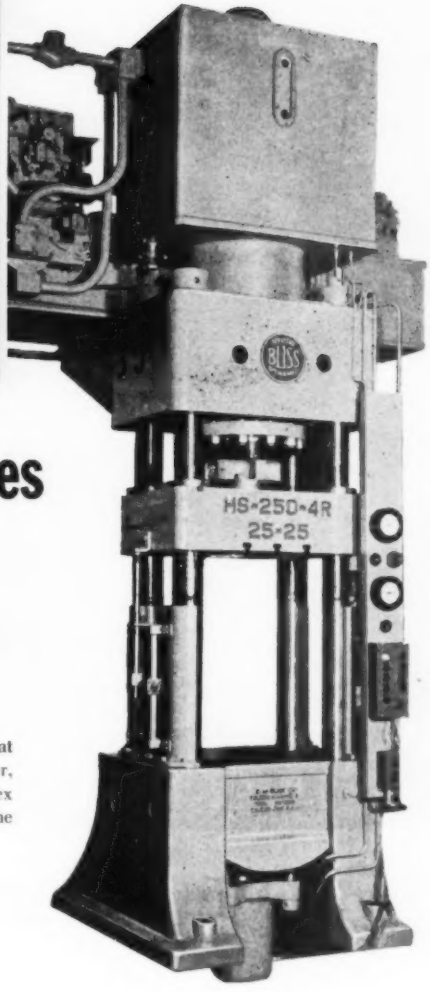


8 Bliss Hydraulic Presses form iron powder into complex turbine blades

Intricate aircraft turbine blades, particularly complex due to the great change required from body to root, are molded from iron powder, coined and straightened in special Bliss hydraulic presses with duplex actions at Thompson Products, Inc. Thompson's engineers credit the process and Bliss presses with these advantages:

(a) *Conserving critical metals and materials*

(b) *Minimizing machining requirements*

(c) *Holding tolerances to ±0.003 in. to airfoil contour... ±½ degree of twist*

(d) *Excellent tool life—tool steel dies deliver up to 250,000 parts*

(e) *Require relatively light pressures*

Features of the Bliss hydraulic presses include dual flow pumps, rapid advance and return speeds, variable pressing speeds, automatic reversal, automatic speed change, overload protection, plus numerous other safety devices and construction refinements.

Bliss has led the way for years in the development of presses to form metal powders...has installations in leading plants using the technique. This experience is yours when you call on Bliss with your equipment problems.

E. W. BLISS COMPANY, Canton, Ohio

Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery

From a Single Press for a Given Job...to a Complete Press Room...

It's Bliss

with an hour off for lunch!

This mountain of die castings is the eight-hour production of one man and a Cleveland Die Casting Machine, working in the shop of a leading West Coast diecaster. The shop reports this Cleveland machine puts out 30% more production than the equipment previously used . . . and their casting quality improved materially. The uniform, porosity-free "hardware finish" castings turned out by this Cleveland enabled the firm to meet their production schedules and also permitted them to accept new business they could not handle before.

You will produce better castings, faster, at less cost with Cleveland Die Casting Machines. Investigate their advantages for your production.

Remember, *Clevelands Cut Costs*

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • NEWARK

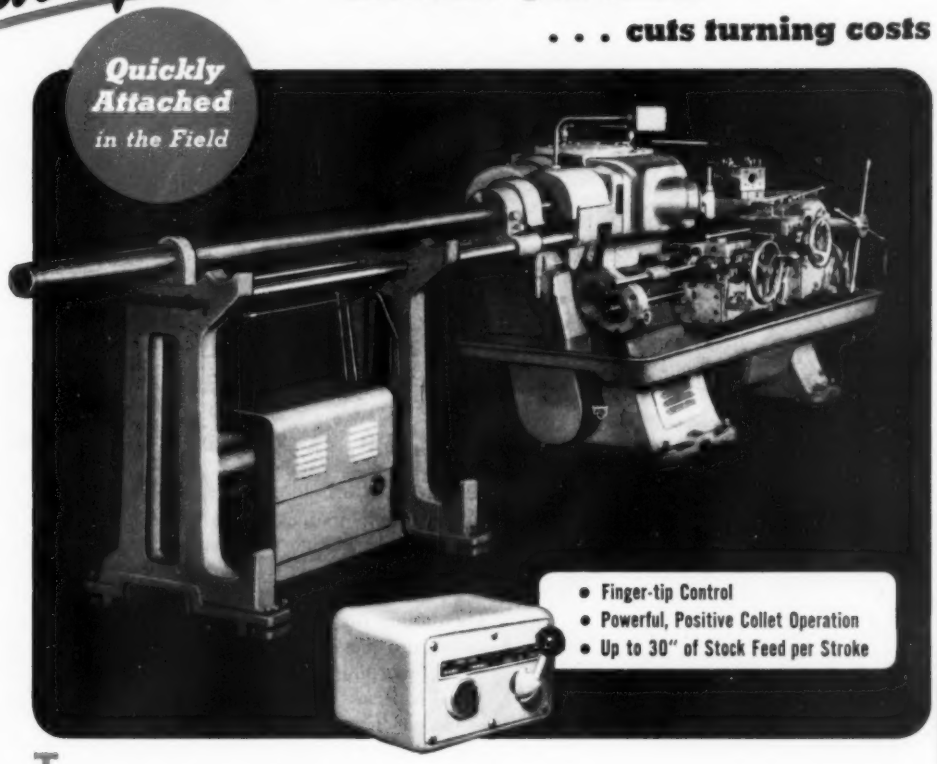
Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

Power Operated

BAR FEED AND COLLET CHUCK

Increases production

. . . cuts turning costs



This new, work-saving development is a rigid, heavy-duty hydraulic unit built to handle full capacity bars at full capacity spindle speeds.

It provides effortless finger-tip control of bar feeding and chucking, enabling operators to *maintain a faster, steadier pace throughout the day.*

It can be attached quickly to ANY J & L No. 3, 4, 5, 7A and 8A Universal Turret Lathe in the field.

★ Handles ● ■ or ⬢ stock
★ Side-loading, silent safety tube
★ Heavy, wide support legs
★ Levelling and floor lagging screws
★ Wide-spaced steel guide bars
★ Feed chuck mounted on anti-friction bearings
★ Independent hydraulic unit
★ Automatic strip-back cycle
★ Auxiliary feed chuck available

Turret Lathe Division **JONES & LAMSON** MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

✓ *Write to Dept. 710 for Complete Information*

broached in a single pass ... the AMERICAN way

Combining *two* operations on an American SB 48-15 Single Ram Vertical Hydraulic Surface Broaching Machine enabled this automotive engine manufacturer to broach the radius and pad (which are non-adjacent) of the front engine cover *in one pass.*

The tooling for this operation consists of generating type broaches and shaving blades mounted on the main machine slide for broaching the radius and joint surfaces. In addition, a special hardened and ground guide is mounted on the table to guide generating type broaches and shaving blades which are pulled down by adapting the lower end of the holder to the machine slide. These broach the pad thus completing the two operations in one pass.

Automatic clamping, plus an automatic sliding table are two additional features of this American installation that help maintain a production rate of approximately 115 parts per hour at 85% efficiency.

Write for your copy of American's Circular 500.

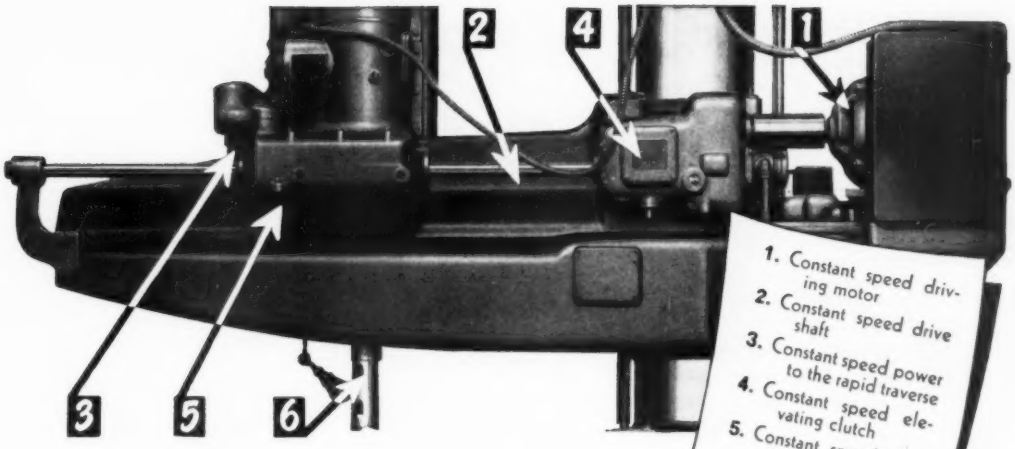
YOU CAN SOLVE YOUR BROACHING PROBLEMS THE AMERICAN WAY

This is only one of thousands of problems solved during American's 25 years of experience in the manufacture of broaching machines, broaches, and broaching fixtures. A part-print or sample and hourly requirements are all it takes to start American engineers working on your problem. Write today!

American BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

SUNDSTRAND

See American First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

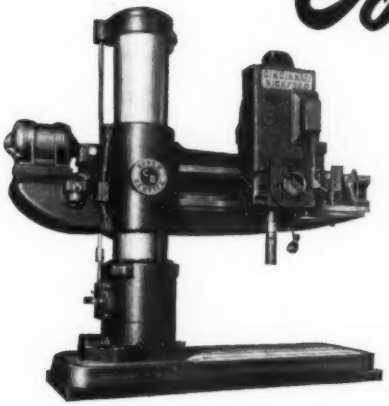


1. Constant speed driving motor
2. Constant speed drive shaft
3. Constant speed power to the rapid traverse
4. Constant speed elevating clutch
5. Constant speed driving clutch
6. Constant power at all spindle speeds

For PERFORMANCE . . . for ECONOMY

. . . for LONG LIFE

Constant Speed



The Cincinnati Bickford Constant Speed Drive gives many advantages: low initial cost, low maintenance cost, long life, and a fine drilling performance.

Cincinnati Bickford Constant Speed Driving Clutches have a long life and a maximum power delivery at all spindle speeds.

Power rapid traverse and power elevation of the arm, constant speed oil pump with its constant oil flow, all without the use of a single extra motor, are further advantages.

As all controls are at the head, and all gear changes are made without stopping the driving motor, Cincinnati Bickford Super Service Radial Drills are outstandingly easy for the operator to control.

Write for Bulletin R-29.

THE CINCINNATI BICKFORD TOOL CO.
RADIAL AND UPRIGHT DRILLING MACHINES
SUPER SERVICE
Radials 7½" dia. col., 2½" arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

TRY THIS *cost-cutting team*

for CARBIDE GRINDING

Wickman Steel-Bonded Diamond Wheels

practically indestructible with extra long life. Diamond particles stay in place until completely worn. Finish tools better for longer tool life.

Wickman Resinoid-Bonded Diamond Wheels

for faster and freer carbide cutting and less frequent wheel dressing.

Wickman Chip-Breaker Diamond Wheels

steel-bonded for much longer life than other chip-breaker diamond wheels. Reduce wheel and tool costs materially and speed grinding 3-4 times.

Complete facts in free 52-page catalog.

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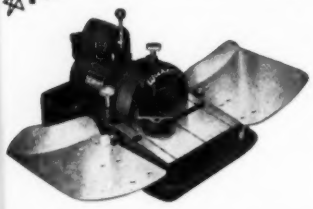
Grinding with Diamond or Abrasive Wheels is

☆FAST! ☆ECONOMICAL!

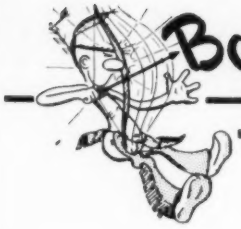


on the Wickman GF-2-A

With 1 HP reversible motor and impeller-type 12 gph coolant pump, this heavy bench grinder delivers fast, economical grinding with both silicon carbide abrasive wheels and Wickman steel-bonded diamond wheels. Wheel guards and splash protectors, three position table for wheel wear adjustment, plus a protractor slot for angular grinding, make this the ideal grinder for all off-hand grinding around the shop.

Delivery From Stock. Send for bulletin.

THE **Wickman** MANUFACTURING CO.
15533 Woodrow Wilson Ave.
DETROIT 3, MICHIGAN



Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

British Protest

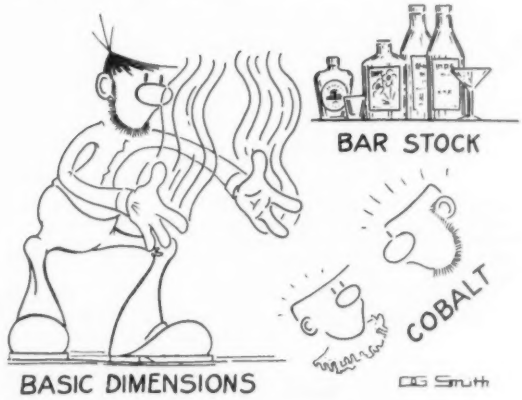
At various times I have read in your publication articles dealing with production in Britain, and I would like to express my thanks for your unbiased attitude.

In view of the present world situation, it is more important than ever that our two countries maintain the closest relationships, and it is too bad that so many American journals —your newspapers, particularly — seem to find such delight in taking digs at us. It would seem that when a visitor comes to this country he deliberately picks out the worst possible factories to visit. Admittedly, some of them are bad, shockingly bad, particularly some of the small cutlery factories in the Sheffield district, but they are not typical British factories. And it is most unfair for these people to publish their one-sided opinions in the public prints. Some of our factories will compare favorably with the finest America has to offer.

After all, not all of your own plants are marble palaces by any means. I visited the States myself a few years ago, and although I saw some places where it would have been a real pleasure to work, I also saw some that I honestly believe would not have been passed by our factory inspectors. But I don't go around telling my friends what terrible places all American factories are.

Then there's the matter of productivity. And let me make it clear from the start that we are not starving here, and that our output is not being lowered by our lack of food. It is true that we don't often see a beefsteak and our diet is a bit on the starchy side, but we are not hungry and our health has never been better. You build your motor cars for high speed because you have hundreds of miles of wide open country where you can tread on the gas. We build ours for lower speeds because our country is so much more crowded and we rarely

GRINETICS — BY D. G. SMITH



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Let us assume *full, undivided responsibility*

TWENTY-TWO YEARS EXPERIENCE IN MANUFACTURING PRECISION HONING EQUIPMENT

MICROHONING MACHINES

MICROHONING FIXTURES

MICROHONING TOOLS

MICROHONING ABRASIVES

DEVELOPMENT-ENGINEERING

TECHNICAL SERVICE

The MICROMATIC HONE CORPORATION has been the principal manufacturer of honing equipment for the past twenty-two years. In that time we have designed and put into production thousands of honing installations. An active research and development program has always been maintained. This has resulted in the development of a new, more precise, production process—MICROHONING.

We have the most complete line of Microhoning machines, fixtures, tools (all designed and manufactured in our own plant) available anywhere. We stock and process honing stones manufactured by the three largest abrasive manufacturers in the country. This, plus a staff of Engineers and Service Technicians that have the greatest honing know-how of any organization in the world, warrants us asking that you LET US ASSUME FULL, UNDIVIDED RESPONSIBILITY FOR THE RESULTS OBTAINED WITH YOUR MICROHONING EQUIPMENT.

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 4, MICHIGAN

District Field Offices: 1323 S. Santa Fe Avenue, Los Angeles 21, California • 206 S. Main Street, Rockford, Illinois • 231 S. Pendleton Avenue, Pendleton, Indiana • MICRO-MOLD Manufacturing Division, Boston Post Road, Guilford, Connecticut • 55 George Street, Bramford, Ontario, Canada

*Micromatic** **MICROHONING**

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Write today for CROSS-HATCH describing the MICROHONING *process*

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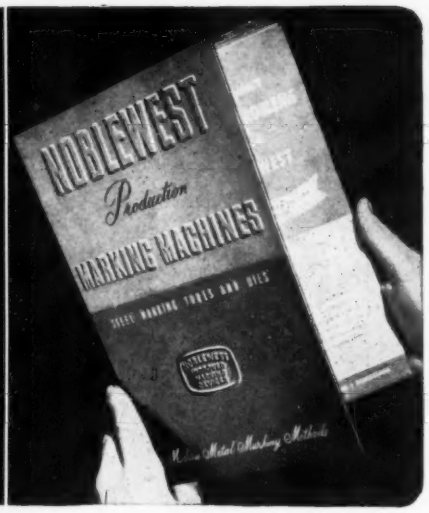

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On vital defense orders, leading manufacturers in many fields are accelerating their production schedules by using Noblewest equipment and methods described in this Guide to Modern Metal Marking. Noblewest rapid precision marking machines are engineered to meet specific requirements for marking, serial numbering, graduating and knurling on pieces of all shapes and sizes. Whatever you make, whether an assembly or complete unit, Noblewest offers equipment to mark it better and faster at lower cost. Being permanently *rolled in*, products marked by Noblewest rapid marking methods meet the most exacting specifications. Send for the Guide to Modern Metal Marking and profit from the skills, experience and facilities of the world's largest manufacturers of rapid production marking equipment. Write to Noble & Westbrook Manufacturing Company, 17 Westbrook St., East Hartford 8, Connecticut.

MARK IT BEST WITH NOBLEWEST

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

have a chance to get our money's worth out of a 150 hp engine. It is the same thing in industry—we are not geared for terrific mass production because we don't have the market to absorb it. Many operations that you perform mechanically, we still do by hand, simply because it is cheaper that way. But when we see that a machine will do the job cheaper and better, we yield place to no one in designing and building it.

I don't want to boast, but I believe the quantity of machine tools we are selling abroad is sufficient proof of their quality and performance. And I protest most vigorously any statement that we are behind the times. Perhaps we do not go ahead as quickly as you, for despite our Socialist government we are still basically conservative, but at least we do not rush into things so far that we get ahead of ourselves and have to wait until other things catch up, or find we are out of our depth and have to flounder back to shore.

Perhaps this letter sounds a little bitter. It is not so intended. Rather it is a plea for a little better understanding on the part of America. We do not seek your pity, nor relish your ridicule. We ask only that you try to appreciate the many difficulties that beset us and that you laugh with us, not at us.

E. M. Lamb
London, Eng.

We keep in fairly close touch with British developments, and we admit there is much truth in what Mr. Lamb says. We fear, however, that he has been reading the wrong papers. Few of us have any desire to laugh at what Britain is doing. On the contrary, we have the greatest respect for her industrial achievements, as so well exemplified in the Festival now being held there.—Ed.

Tetrachloride Warning

In reply to Mr. Homewood's letter (*AM*, July 9) I would like to point out that carbon tet has been known for a long time as an easer upper on some tough jobs, particularly in tapping. I believe the real reason for its working so well is that it contaminates the tip of the tool and prevents the chip from welding to it. We used to squirt it on straight from an oil-can.

But let me add a word of caution! If you use much of it, it can raise the dickens with your skin by taking out all the natural oil. The fumes are toxic, and I believe its use as a

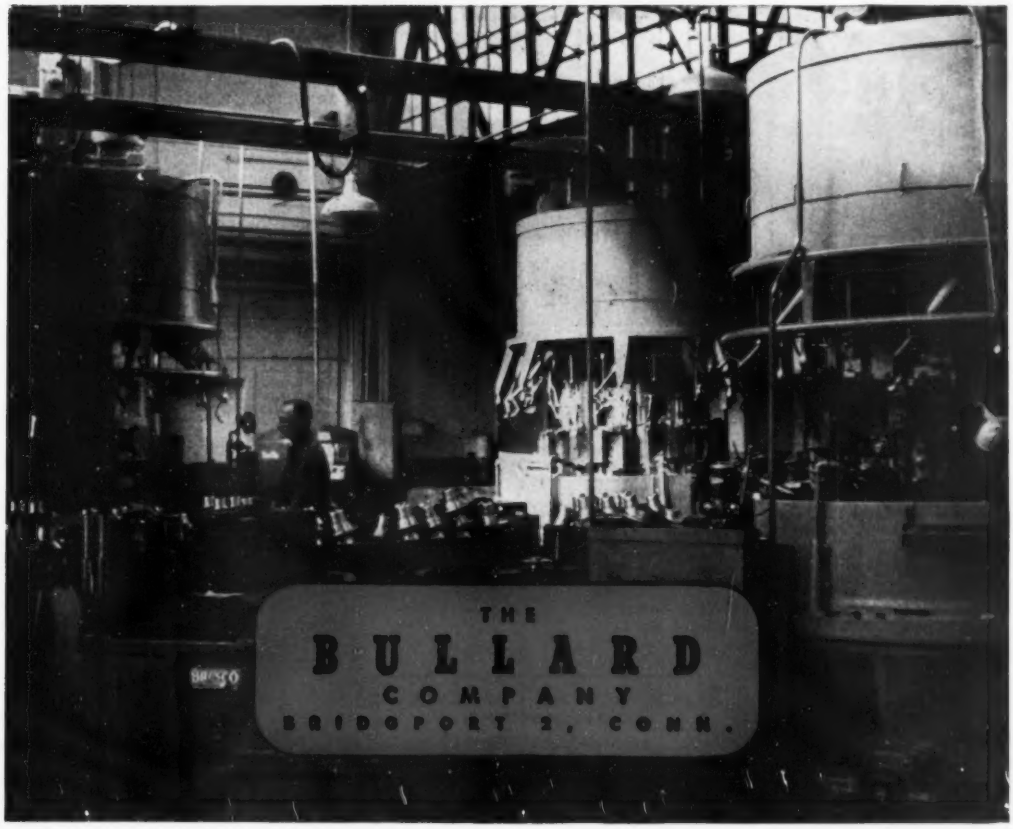
KEEPING PACE WITH TIME . . .

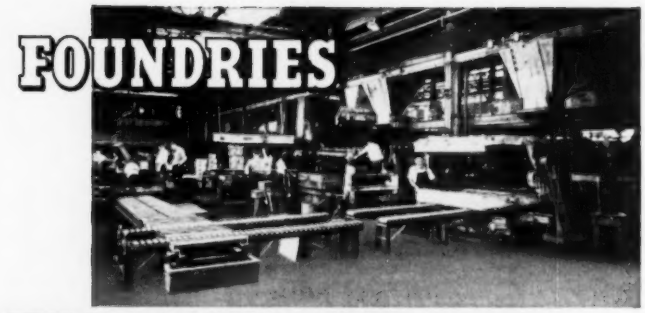
Bullard Mult-Au-Matics

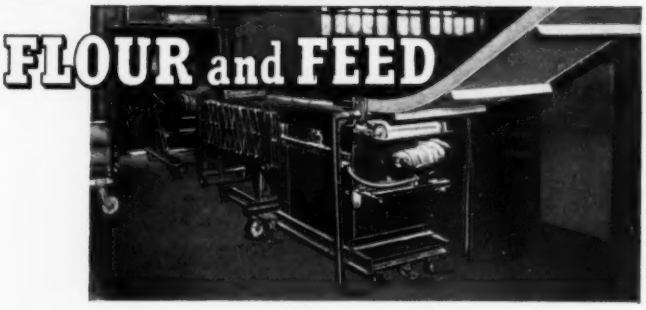
at Spicer Manufacturing Division of Dana Corporation, Toledo, Ohio

Some 30 Mult-Au-Matics — eight spindle type, in 12 and 16 inch sizes, produce a variety of automotive parts. Naturally these machines were installed because of their productive capacity. Since, one Mult-Au-Matic produces the equivalent of three former machines which it replaced. Furthermore, the customer expressed satisfaction with the dependable performance of these machines and remarked on the economies possible with Mult-Au-Matics.

Write BULLARD for Factual Time Savings on your Jobs







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coolant, except in occasional small quantities, is forbidden in most states.

P. Kilhaney
Passaic, N. J.

Mutual Admiration

I notice with considerable pleasure in the June 11 *AM*, an article by Pierre Wilmus, Wavre, Belgium, on "Progressive Die Makes Tiny Cups." As another subscriber — also a Belgian — and a diemaker, would you give me Mr. Wilmus's complete address, so I can correspond with him and compare notes?

When I came to this country, for keeps, in 1948, I was just a fairly good shaper hand. Burning the midnight oil on eight of your McGraw-Hill books, combined with practice in a die shop, helped me to qualify as a diemaker. My ambition is to become a super-duper diemaker.

Incidentally, orchids to you for publishing good stuff from abroad. So many machinists refuse to believe that foreigners can display skill and ingenuity, as well as Americans. Each country has its share of top-notch workers and/or half-baked machinists.

A. T. Renson
Atlanta, Ga.

Way Back When

Referring to our earlier correspondence, I am not sure that any firms on the list deal in used machinery. One name, however, stands out because I think they advertised in *A.M.* back in 1885 or '86 when I first subscribed to this valuable mechanical magazine, at a time when you printed only 16 pages. The firm in question was Hill-Clarke & Co.

I have learned a lot over the years from the *American Machinist*, and am still learning.

Charles A. Trask
Indianapolis

That's quite a feat of memory, or mighty potent advertising, when a man remembers the name of an advertiser for 65 years. Wonder how many more 65-yr readers we have. Ed.

Hammer Forged

Steel makers appreciate the importance of hammer-forging in the refinement of steel and that's why it's universally used from ingot to billet in the making of the higher grades of tool steel.

Hammer-forged GTD-AMPCO drills carry [illegible] process further to the highest possible refinement obtainable in high-speed steel. And, as a fitting climax to HAMMER-FORGING, GTD-AMPCO drills are polished in the flutes, insuring free chip passage, which is so essential in drilling deep holes, cast iron and non-ferrous metals. For the best, insist on GTD-AMPCO hammer-forged drills.

AMPCO TWIST DRILL DIVISION

GREENFIELD TAP AND DIE CORPORATION

Greenfield, Massachusetts

Performance Tested

This man is paid to be nosey . . .

He has just performance tested an "Acorn" Die in an operating holder on specially selected stock. The test plug held in his left hand has been thoroughly gaged for pitch diameter, outside diameter and lead. Now under his magnifying glass, thread quality is visually inspected.

But his "say so" isn't the last word. This test plug will accompany the Die through final inspection and will be packaged with it, tangible proof that the Die is right.

"Acorn" Dies are regularly available in a wide variety of sizes from 0-80 to 1½"-12, with holders for many types of machines.

GREENFIELD TAP AND DIE CORPORATION
Greenfield, Massachusetts

BUY GTD GREENFIELD!

CrysCoat is in Good Company!

*Prepares Metal Surfaces for Painting

*Patented Material and Process

"MEALMASTER", (Knox Stove Co.) the new, revolutionary combination Coal-Electric, Oil-Electric range that cooks, bakes and heats with either fuel is one of Americas' finest ranges. Beautifully designed, sturdily constructed . . . "Mealmaster" is built to give dependable long-life service. And quality manufacture is carried on through to the durable finish. Here all painted surfaces are first CrysCoated for long-lasting paint adherence and protection against the spread of rust in case of accidental damage to the finish.

The Oakite *CrysCoat* Process may be just what you're looking for. With minimum equipment . . . in minimum time . . . at minimum cost you can (1) clean metal surfaces and condition them for painting; (2) improve the adhesion of paint to metal; (3) prevent corrosion before metal is painted; (4) localize corrosion under paint if finish is broken.

The Oakite *CrysCoat* Process Offers These Extras:

1. **Eliminates operations . . . uses less equipment**
2. **Cuts operating time**
3. **Uses less chemicals for cleaning and conditioning**
4. **Reduces heating costs**
5. **Saves cost of expensive acid-proof tanks and equipment**
6. **Saves cost of frequent descaling and desludging**
7. **Drag-out costs are less because of low original cost of solution**
8. **Saves paint**
9. **Cuts cost of rejects caused by rusting before painting**

FREE . . . illustrated folder describes the Oakite *CrysCoat* Process for use in before-paint-treatment of steel, aluminum sheet and castings, zinc die castings and galvanized surfaces. If you are engaged in the fabrication of civilian goods or the speedy production of defense orders—send for Folder F7642.

OAKITE PRODUCTS, INC., 24 Thames St., NEW YORK 6, N. Y.
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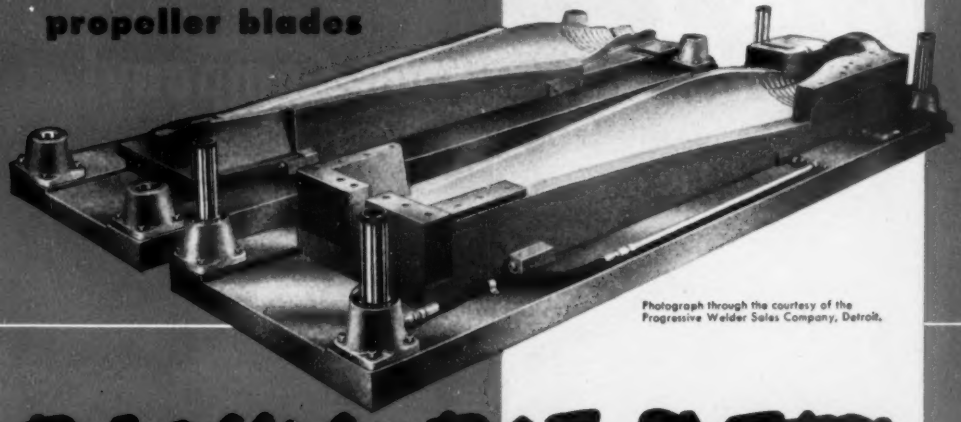
HOT FORMING

aircraft propeller blades

This unique new process takes a previously hot-worked billet and hot forms it into a one-piece hollow steel aircraft propeller. Now, in three steps requiring only a few minutes, a superior propeller is produced that formerly required hours of work.

The development gave rise to the problem of building a special 15 ton die that would provide a quenching action from 1450 degrees in a five minute press cycle.

For a die like this, the diemakers called for . . .



Photograph through the courtesy of the Progressive Welder Sales Company, Detroit.

DANLY DIE SETS

Reliable Danly precision plus unmatched facilities for the production of standard or special die sets like the one shown here make Danly Die Sets the first choice of diemakers everywhere. A nation-wide system of branch assembly plants* assures prompt, time saving service.

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INDIANAPOLIS 4, 5 West 10th Street
*LONG ISLAND CITY 1, 47-28 37th Street
*LOS ANGELES 54, Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2, 111 East Wisconsin Avenue
PHILADELPHIA 44, 18 West Chelton Avenue
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*Indicates complete stock

DANLY

PRECISION DIE SETS • STANDARD AND SPECIAL

MORE THAN 25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

SPOT NEWS of Metalworking

- **Powdered titanium carbide,** combined with 30% nickel and 2% columbium, is being used for manufacture of jet turbine wheel buckets by metal-powder process.

- **UAW-CIO is protesting dismissal** by Hayes Mfg. Co., Grand Rapids, Mich., of an employee who was fired for visiting Moscow as a guest of the Soviet Trade Union.

- **General Motors has been turned down on amortization certificate** for $2.7-million aluminum casting plant at Jones Mill, Ark., designed to produce torque converters for tanks. GM proposed to put plant next to Reynolds' reduction plant at Jones Mill, take aluminum pigs hot from pots and pour into permanent molds. Washington has been asked to reconsider.

- **A "white brass" alloy may be used to replace nickel** as a base for chromium finish on bright decorative automobile parts, as result of research work of Du Pont Co.'s Electrochemicals Department. Chromium, plated over white brass, is indistinguishable in brightness and color from that plated on nickel base. White brass used in Du Pont process is 80-20 zinc-copper alloy electrodeposited from cyanide bath with special brightening agents. Automobile industry is now conducting large-scale trials of this new process.

New set of manufacturers' price regulations is being readied to replace CPR-22, CPR-30 and other tailored orders. Base periods, cut-off dates and allowable costs will be changed to conform with Senator Capehart's amendment. But new price orders will not be out for some weeks. For details see page 136.

- **Cadmium can be used again in bearings for automotive parts.** Its use in silver-brazing alloys has been raised from 19% to 25%. Reason: It has been piling up in inventories.

- **Materials and parts shortages caused layoff** of 48,000 workers in last week of July. About 47,000 of them were in Michigan. Until then, layoffs traced to shortages averaged 5000 a week.

- **You may check off a union assessment,** when properly authorized, but you may not dismiss an employee under a union-shop clause for failure to pay an assessment, NLRB states in ruling involving International Harvester and UAW-CIO.

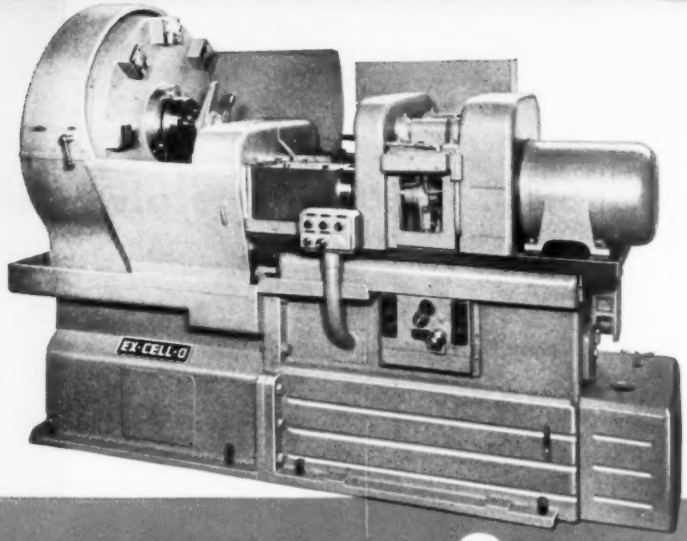
- **Blends of specially-processed waxes dispersed in naphtha or water,** depending upon application, have solved number of difficult drawing and forming operations on stainless steel, aluminum alloy and magnesium sheet parts at the bomber plant of a leading aircraft manufacturer. These wax emulsion lubricants are easily applied by swabbing, roller coating or spraying and will not rub off when dry, but are removed from formed parts by conventional degreasing methods. They are specially good for lubricating dies in hot-stretch-forming magnesium sheets.

Tight zinc supply is forcing plane makers to seek substitutes for forming dies. Metals with lower zinc content, plastics and impregnated woods are being tried.

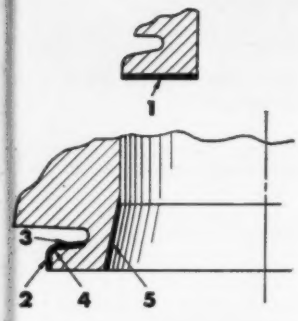
- **Large quantity of surplus shop equipment,** in addition to machine tools, is available to defense contractors at Marietta, Ga., depot of Air Force. Equipment includes: micrometers, height gages, dial indicators, small tools.

- **Surplus machine tools stored at Marietta, Ga., and Omaha, Neb.,** by Air Force can be leased by subcontractors as well as defense prime contractors working on Air Force programs. Charge is 1% per month of machine value. Applications can be made through local district Air Force procurement officer to Facilities Section, Production Resources Division, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio.

Ex-Cell-O One-Way Precision Boring Machine.



5 OPERATIONS ON 8 HOLES IN LARGE JET PART



A TYPICAL EX-CELL-O SOLUTION TO A DIFFICULT PRODUCTION PROBLEM

THE JOB: a large jet engine part requiring complex precision machining.

THE MACHINE: Ex-Cell-O One-Way Precision Boring Machine equipped with two heavy duty spindles and a manually indexed fixture.

THE RESULT: five precision operations on eight large holes (a total of 40 operations). Net production—about three pieces per hour.

Operations performed are shown at left in heavy lines. The front spindle carries a facing head which feeds radially to face the front of the flange (1). The boring head of the rear spindle carries four tools, three of which are on slides. These successively (2) turn the O.D. of the flange, (3) back-face the flange, (5) taper-bore the I.D., and (4) plunge the radius at completion of the back-facing cut. For further information contact your local Ex-Cell-O representative or write direct.

Five operations are performed on each of eight large burner holes in this jet engine part.

EX-CELL-O CORPORATION DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

1-43

Washington

Latest policy switch on mobilization gives industrial expansion top status—ahead of all but most urgent military requirements. Aim is to up basic production—like steel, aluminum, chemicals—about 25% by 1953. To do so, Washington will give this new plant first call on materials, other assistance.

• • •

It's a short-term move. The mobilizers figure heaviest demand for materials and equipment for new plants will have been met by mid-1952. Only a few new plants will be in full operation then, but most of the construction will be finished and equipment will be largely in place.

That's why the military is going along. Arms production won't be disturbed. A few projects—like new bases—may be postponed. But not for long.

• • •

New emphasis on plant expansion shows up in recent production controls actions. Fourth quarter allotments by Defense Production Administration gave industrial construction the biggest single share—about one-sixth of supply—of critically scarce structural steel. And all construction has been placed under Controlled Materials Plan to make sure new defense plants get critical materials.

• • •

New "super-priorities" for machine tool builders are another example. Tool makers can now claim any metalworking equipment in production—even if it has been ordered by the military. Only condition is that the equipment must be used to increase the tool builder's production.

Here's how it will work. A tool maker needing equipment notifies National Production Authority. NPA looks over machine tool order boards, finds out who is making the requested machine. Then it orders the builder to divert the equipment from the customer who ordered it to the tool plant seeking NPA aid.

• • •

Extension of CMP to cover consumer goods production in the fourth quarter came as no surprise. Appliance and furniture makers, even some auto producers, had been clamoring for metals allocations. They felt they couldn't get the metal set aside for them after defense allocations otherwise.

Actually, CMP won't make it easy to get metal for consumer goods. Producers will still have to hunt for the steel, copper, aluminum allocated to them. Military orders have been placed—and they're long term, for the most part. But an allocation will make it easier to place an order with a new metal supplier. He has to take it if he can fill it.

And CMP will help DPA-NPA enforce metals conservation. Applications for allotments will show the controllers just how much metal consumer goods makers use for all kinds of production.

One result may be extensive substitution for critical metals in autos, appliances, etc. For example, NPA already is plugging for substitution of less scarce aluminum for copper in electrical components of consumer goods. The push will get stronger next year as new aluminum production comes in.

• • •

Further cuts in metal use loom for consumer goods even under CMP. Next six months, which will bring top defense demands, may see metal consumption limited to 50% of January-June 1950 level. It's down to 60% for autos, 65% for appliances, other consumer items for October-December.

That doesn't mean a 50% cut in production, however. Substitute materials will help some. So will NPA orders like the new one allowing producers to use total metal allotments as they choose. For example, appliance makers now can use steel allotment for refrigerators to make stoves.

• • •

It's now official. Wages will be allowed to rise with the cost of living—for everybody, if they can get the boss to agree.

Wage escalators will continue to operate as in the past. New escalators may be put into effect. And employers without escalators may raise wages to recompensate for living-cost rise since last January—but not more often than every six months.

• • •

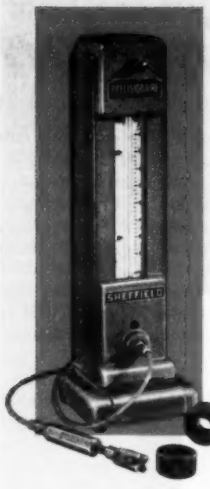
Objective is to preserve the "real value of wages and salaries" as of last January 15. This is beside the 10% "catch-up," which covered 1950. Most "fringes," like pensions and welfare plans, will be extra, too.

Employers without escalators can look for union pressure to (1) adopt an escalator or (2) reopen the wage contract in six months to take advantage of cost-of-living rise of about 5 points by end of year.

• • •

NLRB's reversal of its Ford decision is very limited. It means only this: contracts with union shop clauses made before the CIO and AFL officers signed non-communist affidavits will be respected as a bar to raiding by other unions.

But these faulty union shop contracts cannot be enforced without risking charges of unfair labor practice and back pay. Unless the Taft-Humphrey bill killing union shop polls is passed, NLRB will have to hold 4700 new polls.



The *Sheffield* Precisionaire is an all-around gage

The Sheffield Precisionaire Gage is equally applicable to all phases of inspection—receiving, tool room, process, quality control and final. Practically any dimension or relationship between elements can be measured.

It is ideal for guiding the individual machine operator in preventing scrap loss. It may be used as a comparator. Also, because of its linear scale, it gives precisely the value of the dimensions being measured so that parts may be classified in size ranges. This assures greater accuracy and faster assembly.

The work may be presented to the gage, or the gaging element at the end of a flexible tube may be presented to the work at any distance from the base instrument without loss of accuracy or gaging speed.

The wide range of amplifications from less than 1,000 to more than 100,000 to 1 provides an adequate choice to meet any set of gaging requirements.

Call your local Sheffield representative or write for Bulletin CTP-491 which gives complete specifications.

the *Sheffield* corporation

Dayton 1, Ohio, U.S.A.

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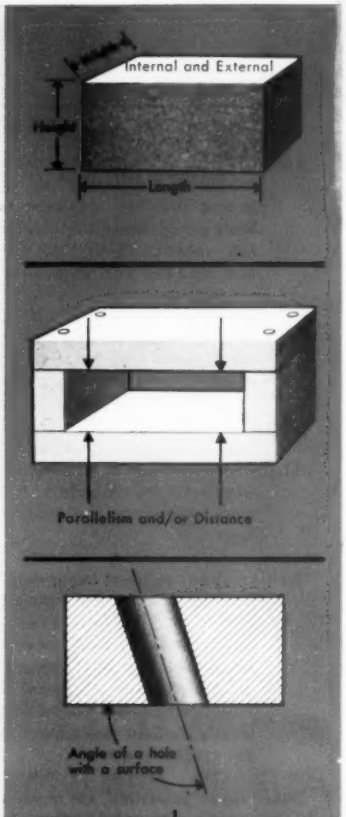
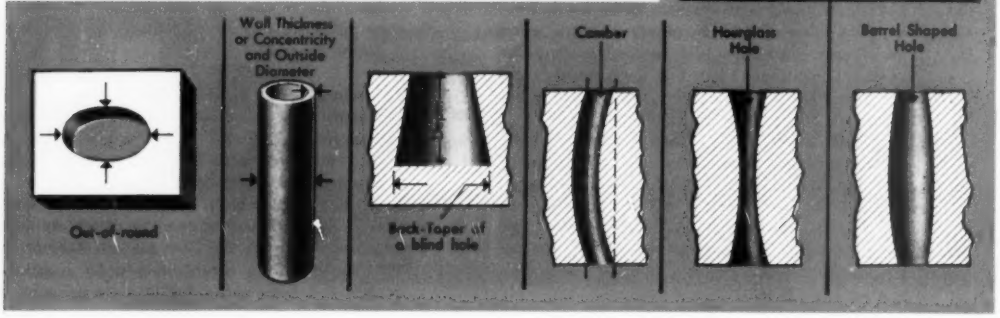




Detroit

Employment in Detroit tool shops continues steady, with slight emphasis on the up side. Delivery promises on jigs and fixtures and gages have lengthened modestly. Meanwhile, promises on sheet metal and forging dies have reduced, indicative of the fact that automotive programs are gradually being completed.

General employment, however, is drifting downward. Foundry, metal fabricating and direct automotive employment reduced. General manufacturing showed very slight gains as the summer went on.

The reason: Automobile schedule cutbacks. Production in recent weeks has held down close to 100,000 car and truck assemblies, U. S. and Canadian plants included, off about 30,000 from June-July schedules. One large reason has been staggered shutdown in many plants of General Motors.

The fourth quarter look is not reassuring, either. Washington is doing what it did earlier—cut back allocations already indicated.

• • •

Pay, meanwhile continues to inch up. For May, last month tabulated, average weekly earnings in all Michigan manufacturing plants were $76.16, based on an average rate of $1.90. The rate for metalworking machinery was $109.03 a week, based on an hourly rate of $2.26. Today those rates are higher—since that compilation annual improvement factors and escalator increases came into play in July.

• • •

How do you set up your tolerances? One or two auto companies have been asking, when they studied blueprints coming to them from aircraft people. They were fairly sure the limits shown on the prints were tighter than actual practice. But as long as the measurements were there to be adhered to, they had no choice but to work within them—or risk military rejection of the parts.

The approach to solving that difficulty seems developing. The aircraft companies will continue to furnish prints as before, and these prints will be used to set up the tooling specified by the plant master mechanic—but not the limits, which would allow for wear on that tooling. Those limits, of course, are also furnished—either on the print, or as supplemental information, so the completed work can be certified without worry by the contracting company.

• • •

Some subcontracting companies have had a parallel kind of problem relative to incoming materials. Specifications from the prime contractor showed fairly rigid chemistry in steel, other basic requirements. Unless the subcontractor was to take a chance, he'd have to reject much material which he felt sure was usable.

Some such companies are now seeking to work out solutions like the aircraft-auto relationships. Their aim is to get actual limits on materials chemistry, rather than the tighter specification limits. With these they are able to accept incoming materials they might otherwise have had to turn down—knowing, in a few cases, that the material might be instantly re-routed right to the company whose specs forbade subcontractor acceptance.

• • •

Back to aircraft-and-auto relationships. Ever wonder why automotive tooling of aircraft plants costs so many tens of millions of dollars?—so much more than the airplane companies themselves could ever have put in?

The answer is simple: Aircraft component plants operated by automobile companies are the big volume producers. Their equipment, therefore, is straight line, single-purpose machinery. That of the aircraft companies themselves—aimed at keeping them in business well beyond an emergency—is flexible, multi-purpose machinery that is best suited for smaller volume. The single-purpose stuff costs much more, of course.

Incidentally, that's a good argument for the fact that auto companies have no intentions of staying in aircraft work—not on a major scale, anyway. Nothing less than war preparations could develop the markets they are geared to produce for.

• • •

Detroit area companies are getting edgy about political maneuvering inside of the CIO Auto Workers. Once John Lewis turned up (he spoke at Ford Local 600, apparently set up a rallying point for Reuther dissenters) the number of wildcat strikes and internal shop pressure began to increase. The basis of arguments which affect management has generally been speed-up charge. The factions generally try to outdo each other in becoming militant over that issue and others—and the company finds itself in the inevitable middle.

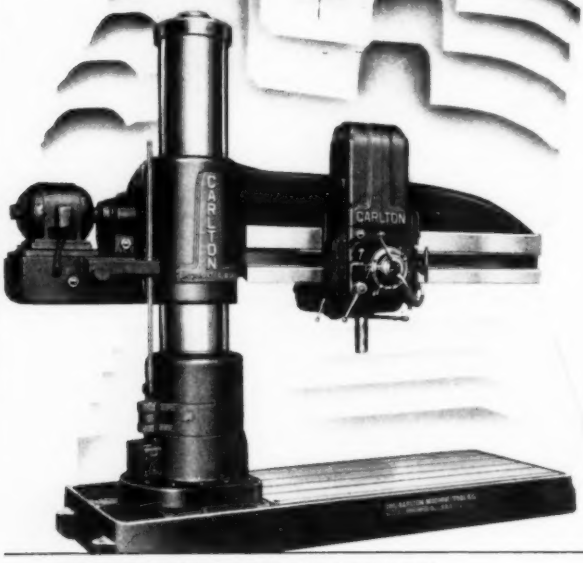
• • •

Detroit is more and more a steel center. On top of recent enlargements for Great Lakes Steel, McLouth, Detroit Steel, and other basic and finishing mills, Ford announced a $43-million expansion. It will add 190,000 tons of finished steel capacity to the Rouge plant, including 37 coke ovens, a new sinter plant, new pig casting equipment, extensive open hearth and rolling mill improvements, and blooming mill alterations for slab rolling up to 60-in. wide.

Technical sessions are scheduled for the Sixth Convention of the American Society of Body Engineers, at Detroit, November 7-9.

Count on Carlton

FOR ALL YOUR RADIAL DRILL REQUIREMENTS



In the broad Carlton line there's a radial that will drill and tap any holes you may have from ¼″ to 10″ diameter. Between the 5A with 26″ column and 12′ arm . . . and the 1A with 9″ column and 3′ arm . . . there are five basic models and many different column and arm sizes. With this variety you can buy exactly the right size Carlton for your requirements.

And with the numerous types of bases and tables available with Carlton Radials, you'll have all the hole production facilities you've always wanted.

Add to this the many Carlton design and construction advantages . . . and you'll find you can count on Carlton for capacity, production flexibility and performance. Why not send today for full particulars? The Carlton Machine Tool Co., Cincinnati 25, Ohio.

THE CARLTON MACHINE TOOL CO., CINCINNATI 25, OHIO

Gentlemen: Please send me bulletin(s) checked below:

- ☐ 1A— 9″ col. 3′-4′ arms
- ☐ 1A— 11″ col. 3′-4′-5′ arms
- ☐ 3A— 13″ col. 4′-5′ arms / 15″ col. 4′-5′-6′ arms / 17″ col. 5′-6′-7′ arms
- ☐ 4A— 19″ col. 6′-7′-8′ arms
- ☐ 5A— 22″ col. 7′ to 10′ arms / 26″ col. 8′ to 12′ arms

NAME _____

ADDRESS _____ CITY _____ STATE _____

Machine Tools

With Defense Mobilizer Wilson doing the prodding, everyone in Washington now wants to help the machine tool industry get going.

NPA has given a "super-priority" to machine tool builders who need machine tools themselves to expand output. What it amounts to is this: builders can ask for machines to be diverted to them from the customers for which the machines are earmarked. They then will be diverted, if the builder submits ample proof that they will help increase production.

• • •

NPA's Metalworking Equipment Division already has the authority to make diversions. The new NPA order merely gives machine tool builders precedence over all other claimants, even the armed services.

• • •

Whipped up by Walter Reuther's proposal to build machine tools in automotive plants, the auto industry went into a huddle with NPA in Washington on August 8 to see what could be done.

NPA would be delighted to have auto companies act as subcontractors to machine tool builders. Aside from General Motors, that is all they could be. They could use their toolroom facilities and that's about all.

The fact is that their tool room capacity is pretty well taken up at present.

• • •

Fisher Body is the main hope for building complete machine tools in the auto industry. In World War II it made at Grand Rapids and Detroit a total of 140 planers, 250 vertical and 48 horizontal boring mills, 25 drilling and tapping machines, and 750 kinds of cutting tools comprising more than 50,000 units.

The thinking in Washington lately has been that Fisher, as well as other auto people, should get any machine tool orders as subcontractors to machine tool builders, rather than as a prime contractor.

Fisher Body admits that it is negotiating with NPA and the Bullard Co. to produce Bullards. It could build 90 machines a month, using space in its seven fabricating plants.

Chances are that if any auto company aside from Fisher Body gets into manufacture of machine tools, they will produce only components as a subcontractor and assembly will be in the machine tool builder's plant.

• • •

DPA chiefs want to carry through this "assist" which the auto industry may give to machine tool builders. But first they must get from armed services a realistic program of what tools are needed. That stems back to the complaint of plane makers that they are hamstrung because the Air Force has not given them "specs" to work on.

Wilson's deputies promise that post-emergency dumping of surplus machine tools on the commercial market will be avoided. But they don't yet know how.

They also say that they have no intention of setting up in the machine tool business any company which might become a post-emergency competitor of existing builders.

• • •

Mr. Wilson has asked all defense agencies to do what they can to make necessary men and skills available to machine tool industry.

Needed by the industry: 500 more mechanical engineers, 500 more tool and die makers, 1000 foremen, 500 skilled machine operators, 40,000 more workers.

Survey of 103 machine tool plants by Bureau of Labor Statistics shows 75 have "recruiting difficulties."

To help solve manpower problems, Mr. Wilson urges further job breakdowns, upgrading, job standardization, on-job training, reduced absenteeism.

• • •

Machine tool builders have open to them three methods of pricing: (1) General ceiling price regulation, which is the freeze of last January; (2) CPR-30 and its amendment which permits extra costs for subcontracting, extra shifts premiums and overtime; and (3) GOR-15. If a builder elects to use GOR-15 and doesn't like it, he can shift to either of the other two methods.

HERBERT L. TIGGES (left) and P. L. HOUSER (right) are director and deputy director respectively of NPA's Metalworking Equipment Division, which is responsible for filling machine-tool requirements for defense program. Mr. Tigges is executive vice president Baker Brothers, Inc., Toledo, and Mr. Houser is general supervisor, manufacturing standard research, manufacturing research department, International Harvester Co., Chicago.

How many lives is a dollar worth?

The cost of a machine, fixture or broach is no gage of how well they will work together and produce together in any broaching installation—and in no process is proper relationship of tools, fixtures, and machines more vital than in broaching.

The wrong broach, fixture or machine always costs MORE.

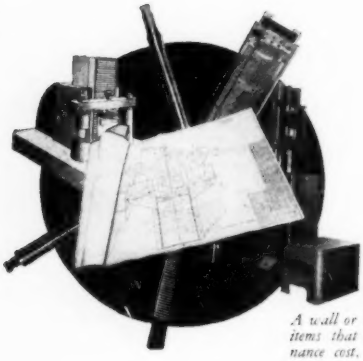
That cost, today, is measured not only in waste of time and money but potentially also *in American lives.*

The time is now. The place—wherever broaching is being adopted to produce more goods—faster . . . with the minimum of precious manpower . . . with the minimum of shut-downs.

To do that, broaching equipment—machine, fixtures, broaches—must be designed, integrated and built to do the job "right the first time."

That's why Colonial is ready and willing to check over your broaching layouts and recommend such changes as appear desirable on the basis of its vast experience with practically every conceivable type of broaching installation.

It costs you nothing. Have Colonial's specialists check broaching equipment or tooling before you release that order.



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A wall or bulletin board poster of DO and DON'T items that should help you reduce broach maintenance cost. No charge. Ask for BN-1250.

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An important reason why Michigan gear tools do both is that Michigan Tool Company has the know-how covering ALL phases of gear production—from blank to finished gear.

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Turbine-quality Texaco Regal Oils were world-famous for years before (R&O) additives came into use. Now, *Texaco Regal Oils (R&O)*, with their special Texaco additives, have *more than ten times the oxidation-resistance of ordinary turbine-quality oils* and vastly greater rust-inhibitive power. And they are specially processed to prevent foaming.

Whatever the type or size of your hydraulic units . . . no matter how severe the service . . . there are *Texaco Regal Oils (R&O)*, approved by leading hydraulic manufacturers, to assure you better performance at lower cost.

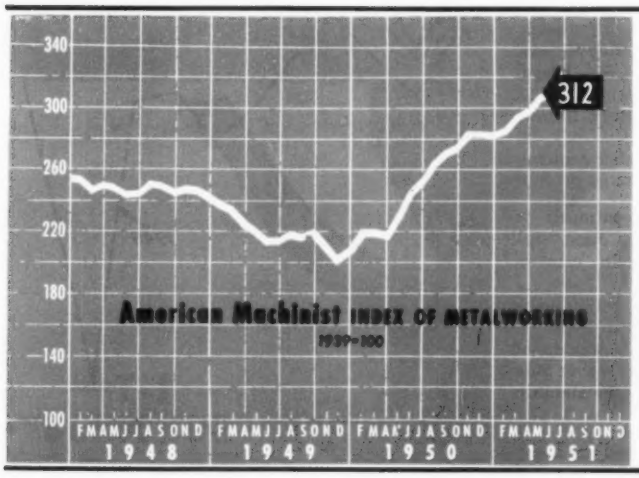
Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd St., New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS

Gaging Metalworking



INDEX

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JULY '51	JUNE '51(p)	MAY '51(r)	JULY '50
	312*	310	309	266
Machinery	303	302		244
Electrical Manufacturing	344	358		303
Automobiles, Trucks	243	245		256
Transportation Equipment	394	373		250
Other Metalworking	322	321		286

* Estimated (p) Preliminary (r) Revised

Lots of Work Ahead in Metalworking

There is plenty of work ahead in Metalworking. But many manufacturers face the most difficult time in years.

It appears impossible to make cuts in civilian output and expansion in defense production dovetail—without idleness and disruption of employment in many places.

• • •

Worries abound. Plane makers complain that Air Force's contracts with them don't mean much until releases of actual "specs" for a stated number of planes of one type come through.

These delays retard tooling. They hold up buying and manufacturing all along the line.

Car and appliance makers aren't sure that their customers intend to spend as freely as in the past year. Yet easing of Regulation W may start an upswing again in sales.

TV manufacturers plan on a pick-up in operations at end of summer. Military equipment lately has taken only 11% of capacity of radio and TV industry, lower than expected.

But impact of broadening of defense work is being felt increasingly. And fourth quarter may bring an upturn in operations.

Bear in mind that manhours worked in the Metalworking industries show no signs of a decline. They were pegged at 312 in July (with 1939 taken as 100). August should hold its own too. And the index may rise in the fall.

Let's look at a large industrial city and see what's going on in metalworking. An auto parts firm is operating full schedule, with employment rising when skilled men can be got. Its truck parts orders offset loss in passenger cars.

Two other auto parts companies report decline in auto volume more than balanced by defense and truck orders. Four big aviation parts suppliers are running full blast, trying to get more men.

Screw machine products maker has all he can do. Nut and bolt manufacturer has less backlog because of auto curtailment, but desk of sales manager is loaded with inquiries.

Appliance maker is down to a 3-day week until materials are at hand to begin a defense contract. Two foundries report solid bookings the remainder of the year. Two machine tool builders are straining to boost production as rapidly as possible. A big defense plant is getting rolling, but won't be humping until end of the year.

On the whole the metalworking situation in the city just cited is typical of that in the nation.

• • •

There's a bit of a lull in buying of industrial supplies, for one thing. Business is off 20% on many items. But volume still is tremendous by normal standards. Sales are off in some other products.

Gaging Business

July industrial production was off 7 points from June, on basis of estimates of Federal Reserve Board index. Actual figure is put at 215 (1935-1939 = 100).

Only seven areas now are classed as having a labor shortage. Plane expansion explains five of them —Hartford, Wichita, Indianapolis, San Diego, Seattle. Increased output of machinery has caused a jam in the Davenport-Rock Island-Moline area.

Augusta, Ga., is the seat of big future labor demand. Reason: Savannah River atomic energy project.

• • •

Inventories of manufacturers have continued to rise. They went up $900 million in June. Significantly, two-thirds of the gain was in durable-goods industries.

Backlogs also have risen steadily. As with inventories, the increase is in durables.

But don't overlook this point: the blowing up of backlogs is slowing down. June's gain over May was $1 billion. Earlier in the year, the monthly increase averaged $3.5 billion.

• • •

Inventories, in addition to being high, still are badly out of balance, so far as raw materials and work-in-process are concerned.

A leading company reports such inventories up 20% compared with January 1; and even then they were 40% greater than immediately before Korea.

Much of the inventory trouble stems from hard-to-get alloy steel and copper. Bearings too are critical, with Washington surveying the possibility of importing a much bigger volume from Europe.

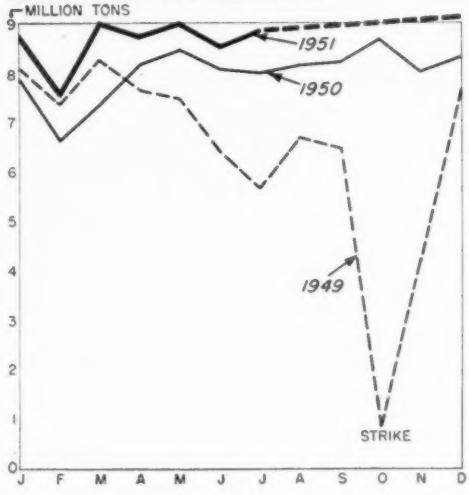
• • •

It's getting to be an old story to say that weekly take-home pay has hit a new high. It did again in June, averaging $65.44.

That is 70 cents more than in April, previous peak, and $7 above June a year ago.

Considerable overtime in defense industries put Metalworking's average work-week over 41 hours in June. Work-week was 40.8 hours in manufacturing as a whole. Surprisingly, it is only a bare fraction above the June, 1950, figure.

GRADUAL RISE IN STEEL OUTPUT



Defense production is adding workers slowly. Aircraft, shipbuilding and metalworking machinery scored increases. Result: total manufacturing employment moved up very slightly in June to 15.9 million.

• • •

Don't get excited about the tiny fall in consumer price index in June. Keep in mind instead an anticipated price hike in fourth quarter.

Washington is pledged to let wages go up as cost of living does. Old escalator contracts will continue in effect. New ones will come in as soon as Wage Stabilization Board approves.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1923-1925 = 100)*	233.5	235.0	219.8
Steel ingot production (thousands of tons)	2,021	2,029	1,927
Electric power output (million kilowatt hours)	7,003	7,005	6,247
Production of automobiles and trucks	116,894	131,598	175,572
Engineering construction awards (*Engineering News Record*, millions)	$216.9	$267.6	$164.0

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators, sales (thousands of units)	309	348	550
Vacuum cleaners, sales (thousands of units)	195	202	250
Washers, sales (thousands of units)	253	254	325
Household electric ranges, sales (thousands of units)	108	110	159
Radio production (thousands of units)	1,083	1,373	1,491
Television production (thousands of units)	327	339	503
Gear sales index (1935-1939 = 100)	800.9	667.1	401.1
Foundry equipment, new orders index (shipments 1937-1939 = 100)	393.2	431.7	622.7

* Seasonally adjusted.

T-J SETS RIVETS and CLINCH NUTS *Faster!*

T-J CLINCHOR

. . . shown here is one of six special 8" throat Underfeed Clinchors used by a large automotive body manufacturer. These Clinchors feed and set 11/16" square cased nuts in outside quarter panels, left and right hand.

TWIN RIVITOR used for riveting flat steel springs to mounting brackets for automobile horns.

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T-J RIVITOR used for automotive clutch plate assembly. Saves time and labor doing a four-fold job —assembling, setting, inspecting and ejecting.

Set clinch nuts 3 to 5 times faster with a T-J Clinchor! Fully automatic . . . controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8" to 36".

For *high production* . . . T-J Rivitors! Automatically feed and set solid rivets. Set 1/16" to 1/4" diam. solid steel rivets up to 7/8" long using *electrically powered* Rivitor. . . aluminum alloy rivets up to 1/4" diam. or steel rivets up to 1/8" diam. and up to 3/4" long, using *air powered* Rivitor. Throat depths, 8" to 36".

Speed up assembly in aircraft, farm machinery, automotive, stampings of all kinds . . . with T-J dependability! Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Company, Jackson, Mich.

35 Years Experience T-J **TOMKINS-JOHNSON**

RIVITORS . . AIR AND HYDRAULIC CYLINDERS . . CUTTERS . . CLINCHORS

Imagine the precision drilling machines that would be necessary to machine this piece on a non-automatic basis. Think of the space, operators, transfers from machine to machine and the time wasted. Contrast that with this specially designed Morris MOR-SPEED High Production Machine.

A single hand clamp fixture holds the work while the machine automatically indexes through four stations. The rear angular head, mounted on hardened and ground ways, carries six spindles for the spot facing operation. The two angular heads on either side alternately drill and countersink the two tap holes. Rated production of 60 pieces per hour is accomplished at 75% efficiency.

Morris MOR-SPEED Production Machines have earned the enthusiastic approval of economy minded production men in the nation's leading plants. Production time, multiple handling, delay between operations and valuable floor space have been saved. If your work requires automatic multiple drilling, reaming, tapping, boring, etc., on a mass production basis, consult Morris Engineers.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Our New and Daring Weapon

America has a new and daring weapon against the threat of World War III.

The old technique was to create a bigger army than any potential enemy. We don't have enough men to do that if we wanted to.

Instead we are expanding our productive capacity in basic materials, like steel and aluminum, and are building new plants to fabricate those materials into armament.

To be specific, we intend to make enough weapons of war to train our armed forces and to fight a war for one year. Beyond that, we plan to tool sufficient capacity in new and existing factories to carry on an all-out war for a long time if it ever should come.

THIS PROGRAM differs from any previous one. Heretofore we have had to ditch unceremoniously the manufacture of civilian goods. We were fighting for our lives and had no choice.

But now we can expand our military production facilities and turn out planes and tanks and guns while also making automobiles and a thousand other peacetime items.

What more sensible approach could we take, in light of our skill as an industrial nation?

The fact is that we are doing what will worry the Kremlin the most. We are not sapping our economic strength and impairing our standard of living by doing without butter in order to have an overwhelming supply of guns.

WE DO NOT INTEND to put ten million armed men into the field. We are smarter than to produce 50,000 tanks to rust from disuse. But we will have ready enough to do a fine fighting job in an emergency.

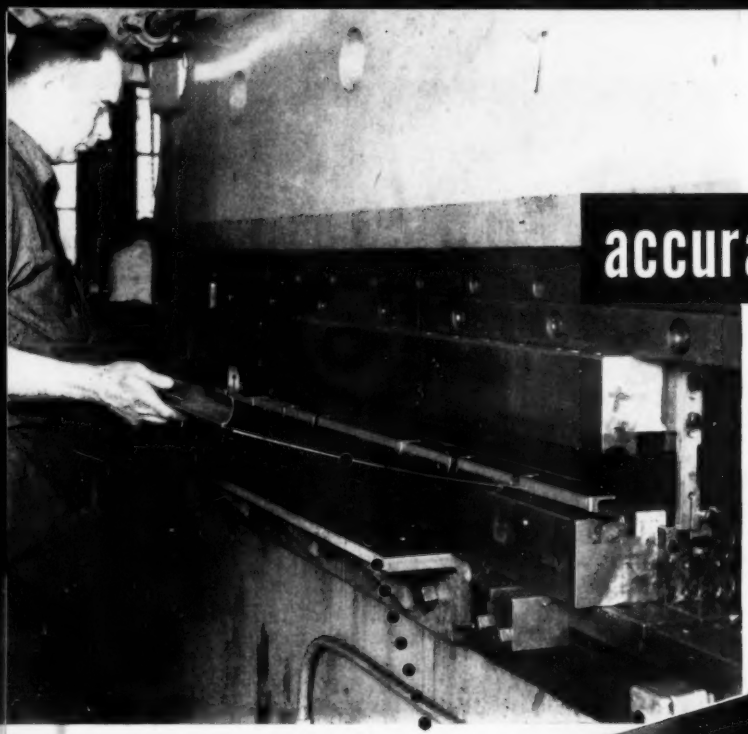
What's more, we will have the industrial resources at hand to turn out more war goods than anyone else while maintaining our normal or near-normal economy. And in a pinch we will be able to out-produce our own World War II total by a very wide margin.

Stalin surely hasn't forgotten that America's productive might was a decisive factor in two world wars and incidentally helped save his own skin less than a decade ago.

HERE THEN is our program for combatting communism. It is the program of Defense Mobilizer Charles E. Wilson. It is sound. It is constructive. It is clean-cut. It deserves enthusiastic support, even if the Korean war should end soon.

We agree wholeheartedly with Chester H. Lang, General Electric vice president, who commented recently on our fight against communism, "We can't outnumber them. We can't outslave them. But we can outproduce them."

Burnham Finney



accurate forming on a Cincinnati solved this problem

Note the clean, straight lines of the moldings formed on the shelf by this Cincinnati Press Brake.

These outstanding sectional Bulman display shelves fit accurately.
Photo courtesy E. O. Bulman Mfg. Co., Inc., Grand Rapids 2, Michigan.

Accurate forming paid off in three ways for Bulman Company, manufacturers of steel display shelves.

Trouble had been experienced in maintaining regularity of product. Now the clean, straight line formed from end to end of the shelving permits a perfect match-up of sections, eliminating a costly trim piece.

Better product, with no discards, and one piece completely eliminated, were the results when this Cincinnati Press Brake was installed . . . it was a profitable investment.

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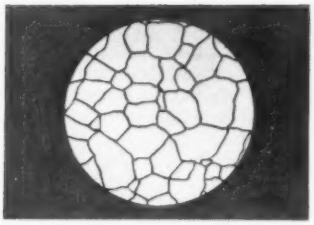


Fig. 1.. Crystals or grains of pure iron are roughly spherical in form. Atoms in any one grain are aligned uniformly, but the alignment varies from grain to grain. Grain boundaries consist of atoms with alignment that gradually changes from one neighbor to another

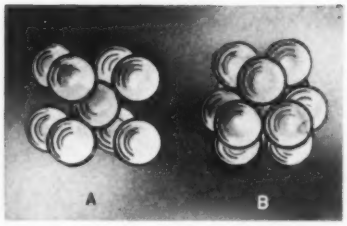


Fig. 2.. Allotropic atomic arrangements of pure iron: *A*—body-centered cubic (alpha) iron, which is stable at low temperatures; *B*—face-centered cubic (gamma) iron, which is stable above 1670 F. Grain size is reduced by strain recrystallization or suppressing an allotropic transformation

METALLURGICAL CONSIDERATIONS IN MACHINING..I

WHAT UNDERLIES TOOL LIFE AND FINISH?

Because tool life and finish are directly related to microstructure of ferrous metals, and not to physical properties as often supposed, we must know how heat-treating processes affect microstructure

By MILTON C. SHAW and PRESCOTT A. SMITH
Associate Professors of Mechanical Engineering,
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

MACHINABILITY is not a precisely defined concept. To most tool engineers machinability connotes a combination of characteristics: (1) tool life for a particular tool material-workpiece combination, (2) surface finish and (3) power consumed. Relative importance of these three items depends upon the nature of the operation, the equipment available, and product use.

Where the major objective is to remove a large amount of stock quickly and cheaply, tool life is the item inferred by "machinability." On the other hand, performance on certain finishing operations is related primarily to ability to produce a smooth surface of precise geometry. Generally speaking, power consumption is of secondary importance, and is of interest only as a measure of probable tool life.

To explain machinability, one could consider a large number of specific jobs. This case method is the usual approach, but it is weak because it fails to provide direct means for solving problems beyond the range of the reader's current experience. Instead, we prefer the scientific method whereby observed performance is formulated into rules or concepts that can be broadly applied.

On many occasions, it has been demonstrated that tool life and finish *are not directly related* to workpiece hardness, yield point or ultimate tensile strength. But, it has been demonstrated many times that tool life and finish *are directly related* to the microstructure of the metal, as revealed by metallographic examination. Further, **similar metallographic structures exhibit similar machining properties, regardless of their relative physical properties.** This being the case, it is logical to expect that we can predict tool life and finish if we have a basic knowledge of:

1. How important metallographic structures are produced.
2. Properties of tool materials.
3. Tool wear classified by types.
4. Relation of metallographic structure to tool wear and finish.

How Metallurgy Sets the Stage

All commercial metals are made up of many individual crystals or grains, the strength and hardness of a given material depending upon its mean grain size, Fig. 1. Of the several ways of specifying grain size, the ASTM method is the most widely used for ferrous metals. This consists of giving numbers from 1 to 8 to

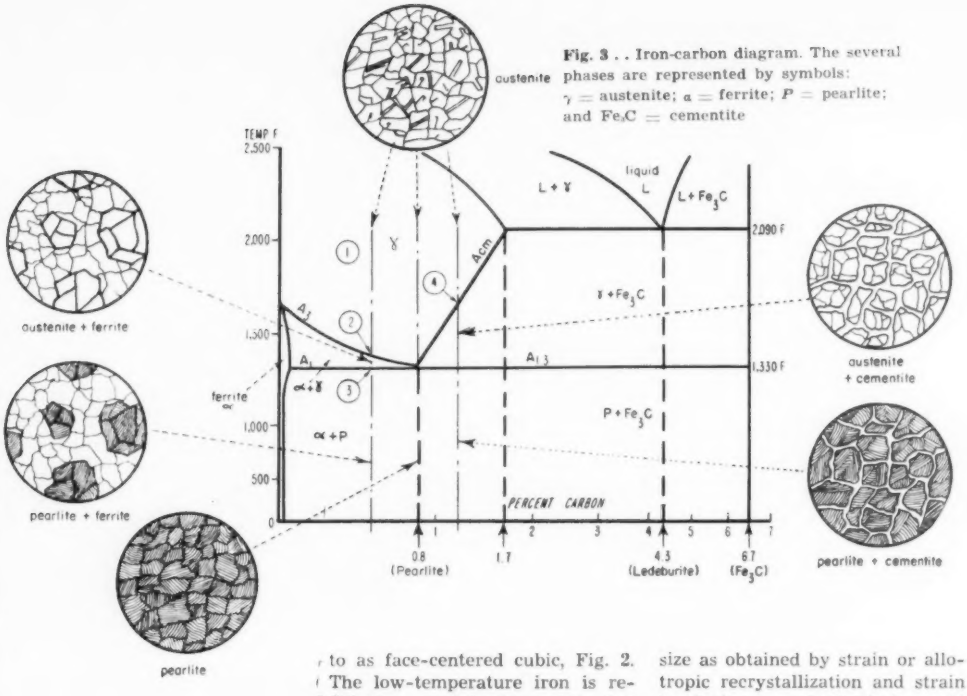


Fig. 3 . . Iron-carbon diagram. The several phases are represented by symbols: γ = austenite; α = ferrite; P = pearlite; and Fe_3C = cementite

grains of decreasing size. A No. 1 grain is about 0.010 in. in dia while a No. 8 is about 0.001 in. in dia.

Two important characteristics of metals are tendencies to strain harden and to recrystallize. When metal is plastically deformed, it becomes harder and stronger. This effect—strain hardening—is most pronounced in fine-grained metals. When a metal strain hardens, its grains change in shape from roughly spherical to elongated form. If strained metal is heated, there is a recrystallization temperature at which new spherical crystals begin to form. For iron the recrystallization temperature is about 1200 F. This process is called strain recrystallization, and commercialy as process annealing.

IRON

For iron there is still another type of recrystallization known as allotropic recrystallization. When iron is heated above 1670 F, the atoms rearrange themselves in the solid grains from a configuration known as a body-centered cubic arrangement to one that is referred to as face-centered cubic, Fig. 2. The low-temperature iron is referred to as alpha iron while that having the face-centered cubic configuration is gamma iron.

Redistribution of grain boundaries occurs when iron is cooled or heated through the 1670 F. transformation temperature. There are thus two ways in which new grain boundaries may be effected and the grain size reduced: (1) by strain recrystallization or (2) by an allotropic transformation.

It is convenient to define two types of deformation. By cold work we mean any plastic deformation that occurs at a temperature below that for strain recrystallization, while hot work refers to plastic deformation at a temperature above the recrystallization temperature. It is evident that a material will strain recrystallize as fast as it is deformed during hot working, and hence this process is an effective way of refining the grain size. Strain hardening is thus associated with cold working only.

If only pure metals were machined commercially, it would be simple to obtain the best structure with respect to machinability. This would merely consist of providing the optimum combination of grain size as obtained by strain or allotropic recrystallization and strain hardening as obtained by cold work. However, when metals are used in the form of alloys, the situation becomes more complex.

STEEL

Steel is basically an alloy of iron with up to about 1.5% carbon. The wide range of hardness possible in steels is a consequence of the carbon present, the manner in which it is associated with iron, and the aggregation of the resulting phases. A phase relates to any homogenous, mechanically separable constituent of an alloy. Important phases of steel are:

1. *Ferrite* — a solid solution of about 0.025% carbon in (body-centered cubic) iron.

2. *Cementite* — an intermetallic compound consisting of a definite lattice arrangement of iron and carbon atoms. The relative numbers of each of the atoms present in a given sample being in accordance with the formula Fe_3C.

3. *Austenite* — a solid solution of up to 1.7% carbon in (face-centered cubic) iron.

A phase diagram is a chart which shows the number and nature of phases that are present in

a given alloy at any temperature and composition under *equilibrium conditions*. The iron-carbon diagram, Fig. 3, is such a phase diagram for steel. This chart merely tells which of the three steel phases (ferrite, cementite or austenite) are present at a given temperature and carbon concentration when the alloy is cooled or heated slowly enough so that it remains in a state of equilibrium.

A phase diagram reveals nothing about the state of aggregation of the phases present. In the temperature region in which both ferrite and cementite are present, the iron carbon diagram does not tell us the relative sizes or shapes of individual particles. This information is obtained by microscopic examination.

Use of Phase Diagram

If a steel with 0.5% carbon is cooled *slowly* from a high temperature, the phase transformations that occur may be followed on the iron-carbon diagram. At (1), Fig. 3, the metal is entirely austenite and remains in this state until temperature (2) is reached at line A_3. Now, ferrite starts to form along the grain boundaries of the austenite, and increases as the temperature falls from (2) to (3). At temperature A_1 the remaining austenite has 0.80% carbon content and will transform at constant temperature into alternate plates of ferrite and cementite. This plate-like, or lamellar, structure is known as pearlite. At all temperatures below the A_1 line (1330 F.) we still have a mixture of ferrite and pearlite.

The changes that occur when a eutectoid steel (steel of 0.8% carbon) is cooled are also shown in Fig. 3. Nothing happens until a temperature of 1330 F. is reached. Then all of the metal transforms at constant temperature into pearlite. When a steel having a carbon content of 1.2% carbon is cooled, cementite first precipitates out along the grain boundaries at point (4) (A_{cm}). This continues until temperature A_1 is reached, when all of the remaining material transforms into pearlite. There is no further change in structure below temperature A_1.

The ability of steel to harden depends upon the difference in carbon solubility of austenite and ferrite, and the tendency for excess carbon to precipitate in the form of cementite when austenite transforms to ferrite. If the steel is quickly cooled as it crosses the 1330 F. transformation line (A_1), the precipitated particles of cementite will be very small and closely spaced. On the other hand, if the steel is slowly cooled as it crosses the A_1 line, the particles of Fe_3C will be larger and more widely spaced.

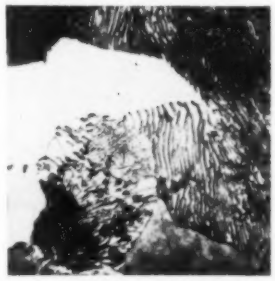


Fig. 4..Lamellar microstructure consists of alternate plates of cementite and ferrite, and is called pearlite. Relative spacing of the cementite plates determines whether the pearlite is coarse or fine. Magnification: 1000x

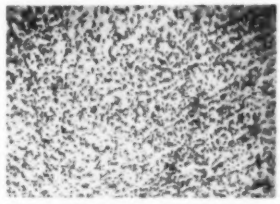


Fig. 5..Spheroidal microstructure consists of roughly spherical globules of cementite (dark particles) in a matrix of ferrite (light regions). SAE 8640 steel

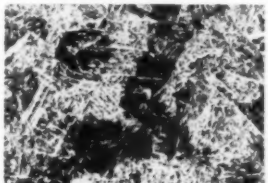


Fig. 6..Acicular, or Widmanstätten, structure consists of cross-hatched ferrite needles (light constituent) in a matrix of very fine pearlite

Types of Cementite

As revealed by microscopic examination, shapes of three general types of cementite particles are:

1. *Lamellar type* — the layered structure already described, consisting of alternate plates of cementite and ferrite and called *pearlite* (Fig. 4). There are coarse and fine pearlites, depending upon the relative spacing of the cementite plates.

2. *Spheroidal type* — roughly spherical globules of cementite in a matrix of ferrite. When the globules are relatively large, this structure is *spheroidite* (Fig. 5).

3. *Acicular type* — a cross-hatched, needle-like structure of ferrite needles in very fine pearlite. This structure is known as the *Widmanstätten structure* (Fig. 6).

If 0.5% carbon steel is *very slowly cooled* from above the A_3 line, the resulting structure will be spheroidite, while if it is cooled somewhat less slowly pearlite will be formed. Coarse pearlite is obtained at a slower cooling rate than fine pearlite. The Widmanstätten structure may be obtained if the specimen is cooled at a critical rate from a high temperature.

Isothermal Transformations

If the specimen is very rapidly cooled, complex changes occur which lead to very hard structures.

If steel is heated above A_3 line (Fig. 3), the iron carbide will decompose, the iron will transform to the gamma form, and the carbon will go into solution. The resulting structure is austenite. If specimens in the austenitic state are rapidly quenched to a temperature below A_1 and held at this temperature for varying lengths of time, the time at which the resulting transformation starts and is completed may be determined by metallographic examination.

When these beginning and end-point times are plotted against the transformation temperature, S-curves like those shown in Fig. 7 are obtained. Various structures and hardnesses are observed for the different transformation temperatures. For a transformation temperature near A_1 the resulting structure is coarse pearlite and the steel is relatively soft. As the

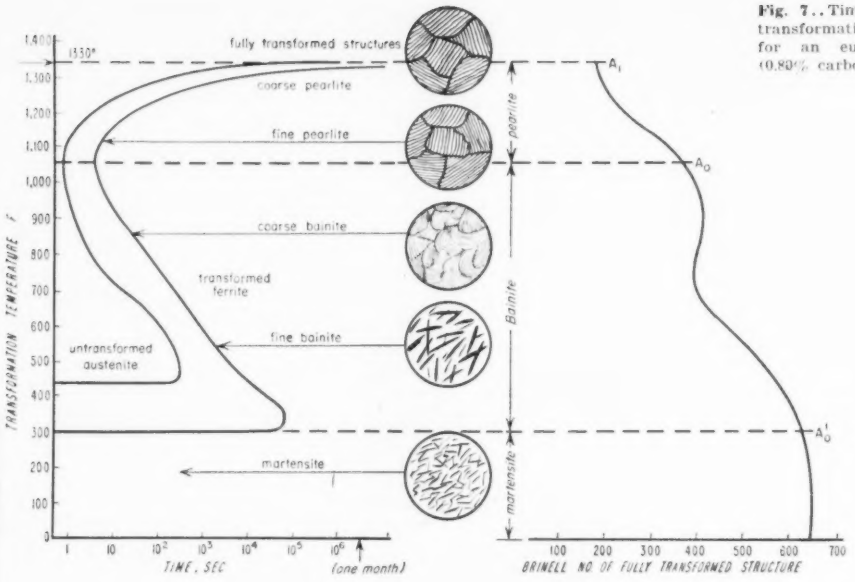


Fig. 7. . Time-temperature transformation diagram for an eutechoid steel (0.80% carbon)

Fig. 8. . Austempering, which causes phase transformation at constant temperature by quenching into heated salt baths, produces these microstructures at the respective stages: Above—at 925 F, feathery bainite plus nodules of very fine pearlite; Below—at 450 F, acicular bainite in a matrix of ferrite (Photos by J. R. Vilella, U. S. Steel Co.)

transformation temperature is decreased, the pearlite becomes finer and the steel harder. This trend continues until temperature A_0 is reached. For transformation temperatures below this, a new structure is obtained known as bainite which consists of a feathery combination of cementite and ferrite (Fig. 8). Bainite is obtained at temperatures from A_0 to A_0', the material formed at the higher temperature somewhat resembling pearlite, while that which is formed at the lowest temperatures is finer and harder and has a more acicular structure of Widmanstätten type.

When the transformation temperature is below A_0', martensite is obtained. Significant readjustment of the iron atoms (Fig. 3) occurs during ordinary transformation of gamma iron to alpha iron upon cooling, and the change requires time. If the metal is cooled very rapidly, super-cooled gamma iron results before the material has time to re-arrange itself. And now the time is increased for re-arrangement and internal stresses arise. Hence, the iron transforms into distorted ferrite, which is called tetragonal martensite (Fig. 9), a hard and brittle substance.

Plain carbon steel is never used in the as-quenched form. It is tempered by reheating and holding at a temperature below A_3, so that the body-centered tetragonal ferrite transforms to the more stable body-centered cubic arrangement. Excess carbon precipitates as Fe_3C particles, the structure becomes softer, and internal quenching stresses are largely relieved.

Part II of "Metallurgical Considerations in Machining" *will appear in an early number.*

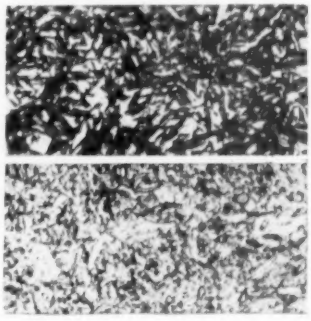
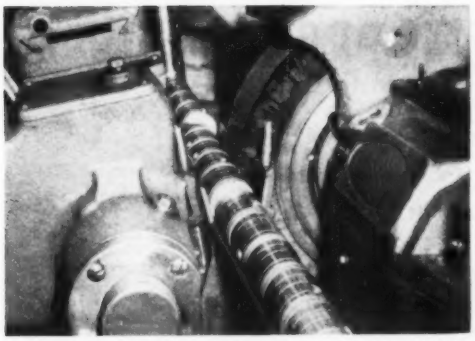
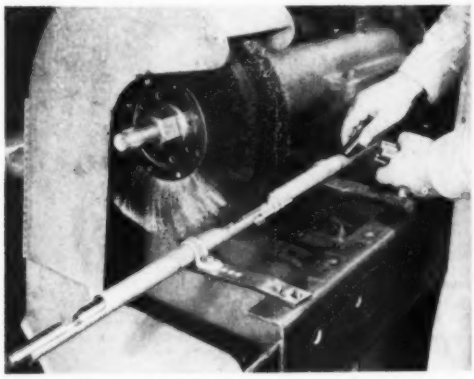


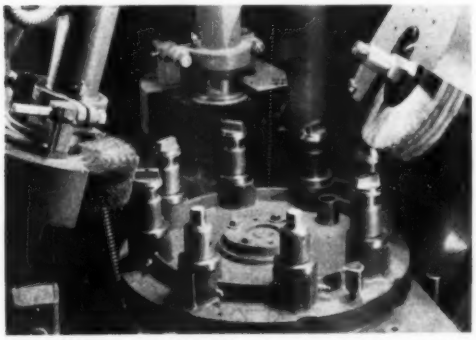
Fig. 9 . . Rapid quenching produces hard and brittle martensite (above). Tempering produces a better structure (below) that is softer and has reduced internal stresses



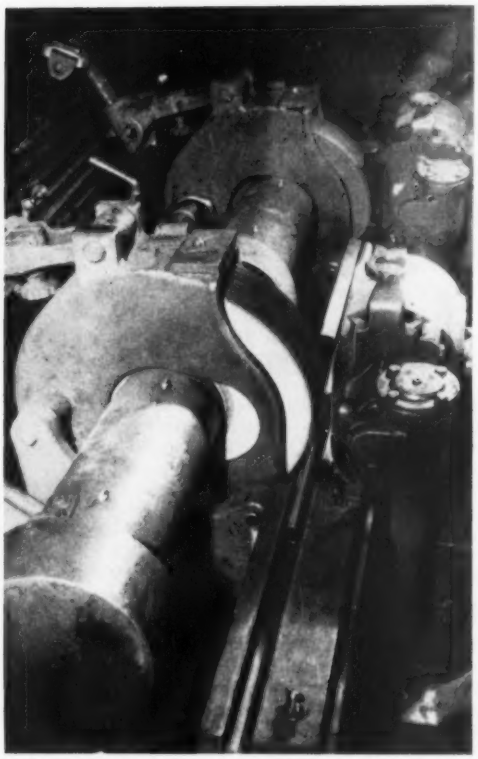
Compressor pistons are centerless brushed with a 20-in. Osborn brush on a Cincinnati centerless grinder. Brush is made of 0.005-in. crimped wire, rotates at 1200 rpm. Process removes grinding residue and blends sharpness of surface, thus reducing cylinder and piston wear



Gaspipe fixture for holding threaded parts. Setup is simple, but produces considerable savings. Parts to be deburred are fed into the right-hand slot; gravity and the brushing action do the rest. Small flat brush clipped to pipe acts as brake to slow work rotation



Triple-head, automatic machine removes heavy burrs from steel parts. Brushes used are all different. Left-hand brush is fine wire; center is a coarser wire; and right-hand is a tampico fill. Note the high polish produced on finished part at right after passing tampico brush



Cold-rolled tube is polished to 8 mu in. on in-line machine. Setup wheel takes first cut, then Osborn Fascut sections finish with grease-bound abrasive. Friction drive (right) rotates and feeds work through polishing zones. Time is 45 sec for a 4-ft section of tube

SLICK TRICKS WITH BRUSHES

BY H. E. LINSLEY, ASSOCIATE EDITOR

Power brushing is an old and reliable method of removing burrs and obtaining a desirable surface finish, but here are some engineered setups for making a production operation of it

4 NEW METHODS SPEED PRODUCTION AT

Here are four widely differing setups that illustrate how careful analysis leads to new ways of doing jobs better and faster. Ingenious tooling replaces conventional methods with production increases of as much as 500%

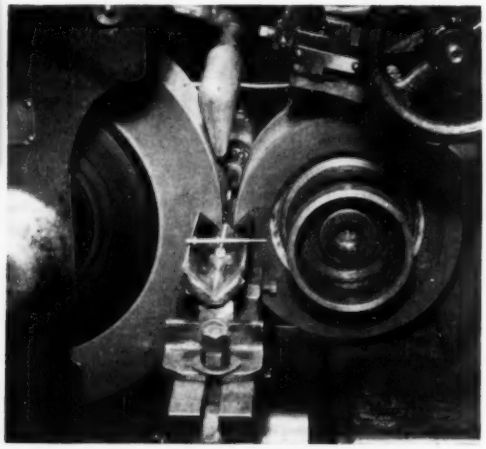
BY F. J. CLAS, Production Methods Supervisor
WATERVLIET ARSENAL, WATERVLIET, N. Y.

1. POWERED BRAZING FIXTURE INCREASES OUTPUT 500%

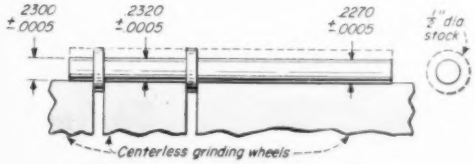
OLD .. Two steel components consisting of head and sleeve formerly were silver soldered one at a time in a contour-wound circular coil. Parts were loaded through the coil from the top onto a locating plug. Complete cycle was 36 seconds.

NEW .. The operation now consists of placing the lower end of the sleeve on a locating pin and pushing the upper portion into position. The sleeve is held in position by a flat spring mounted on the underside of a transite plate. The head rests on a small carbide button which maintains dimensional accuracy of position. Loose-fitting transite plugs are placed in the upper end of the sleeve to minimize the amount of solder flowing into the bore.

Continuously rotating fixture has 24 stations for silver soldering two-piece assembly. Fixture is driven by a variable-speed unit. Power for coil is supplied by a 30-kw electronic heating unit. Parts are soldered one every six seconds



Setup: Three grinding wheels dressed to 7/8-, 9/10-, and 2½-in. widths mounted in No. 2 Cincinnati centerless grinder complete roughing operations in 1.2 min. Production is up 500%



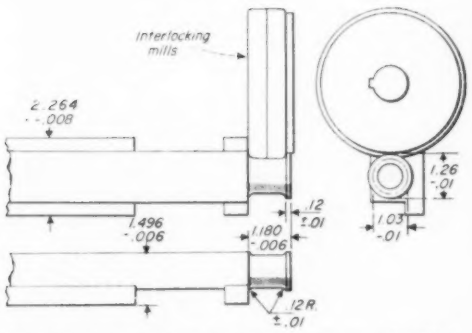
Operation: To rough-machine three diameters

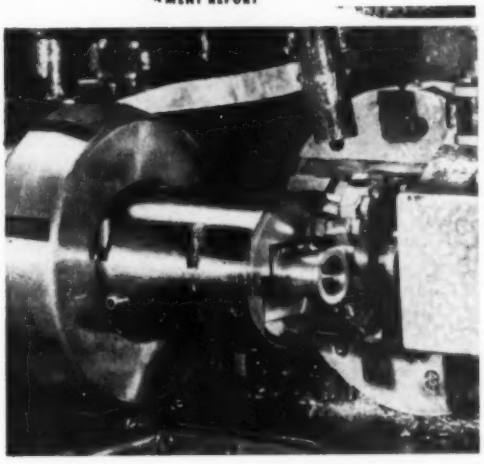
2. CENTERLESS GRINDER CUTS TURRET-LATHE TIME 80%

OLD .. Three diameters (0.230, 0.232 and 0.227 in.) were machined with form and box tools on a turret lathe. The slender high-alloy bar sprung easily, sizes were difficult to maintain, scrap was high, and tools had to be kept exceptionally sharp to avoid chatter.

NEW .. Three wheels of different widths now are mounted simultaneously on the spindle and are plunged to depth with hand feed. Six thousand pieces are ground with one set of wheels, size is more uniform for secondary operations, and tool maintenance is eliminated.

WATERVLIET ARSENAL





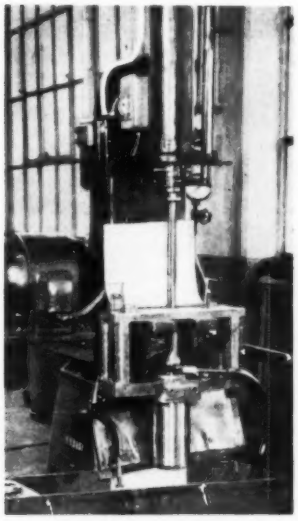
Operation: To produce formed section on 1.5×2.25-in. rectangular bar of 4340 steel, heat-treated to 400 Bhn

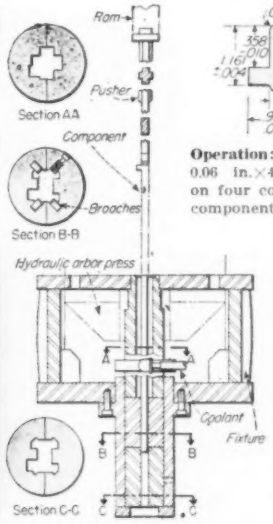
Setup: Formed milling cutters on Lees-Bradner machine mill complete contour in 6 min. Production is up 70% over former turret-lathe operation

3. MILLING CYLINDRICAL FORM UPS PRODUCTION 70%

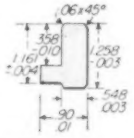
OLD . . The cylindrical section on a gun body formerly was produced in a turret lathe with two form tools, one for roughing, the other for finishing. The square stock was hard on the cutting edges and the tools had to be ground every hour. Chatter and tool marks on the work were a problem, and an experienced man was required for the job.

NEW . . The work now is held securely in a pot chuck, and the contour is milled in one revolution of the work. The cutter runs at 30 rpm, has staggered teeth, and rotates in the same direction as the work. Production is up, cutters run for 8 hr before sharpening is needed, and relatively little skill is required to operate the machine.





Setup: Corner chamfers are push-broached in 20 sec on 4-ton Greenerd arbor press. Original milling time was 2 min

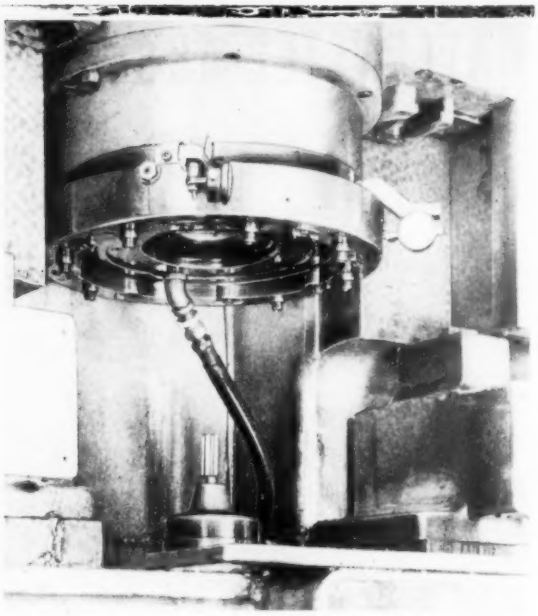


Operation: To produce 0.06 in.×45° chamfers on four corners of gun component

4. BROACHING FOUR CORNERS INCREASES OUTPUT 500%

OLD . . Two chamfers were milled at one time with a pair of 45° angle cutters in a No. 2 horizontal milling machine. Two operations were required for completion.

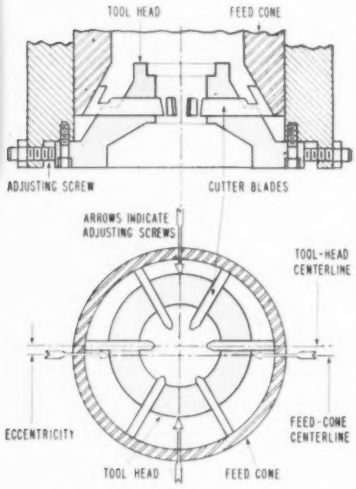
NEW . . The broaching setup eliminates clamping and completes the operation in one pass. The work is loaded into a guide, section AA. The formed pusher then drives the piece past four broaches inserted in section BB, and through the bottom guide, section CC. Chips are flushed clear of the cutting teeth by a heavy volume of oil delivered through a circular gland just above the broaches.



Straight-sided, six-tooth spline ¾ in. dia by 2 in. long is form-cut on Shear-Speed machine in 11 sec. For 50 shafts, total tooth spacing variations did not exceed one-half the 0.0016 in. maximum allowable

SPLINES CUT FASTER, MORE ACCURATELY

BY DON THATCHER, SUPERINTENDENT, MACHINE DIVISION, PLANT I • THE MAYTAG COMPANY, NEWTON, IOWA



Tooth spacing errors are compensated for by eccentric adjustment of the tool head with respect to the feed cone

Processes or equipment that give either increased output per machine or manhour, or else better quality through closer tolerances and improved finish, are not difficult to find. More rare is the process or machine that will give both—at a decreased cost per piece.

One such process was recently applied to production of a key part in Maytag washing machines—the spline shaft which operates the Gyratator. This spline shaft is subject to constant reversals of load. It is essential for life and quietness that the fit of the splines in the hub be held to close limits.

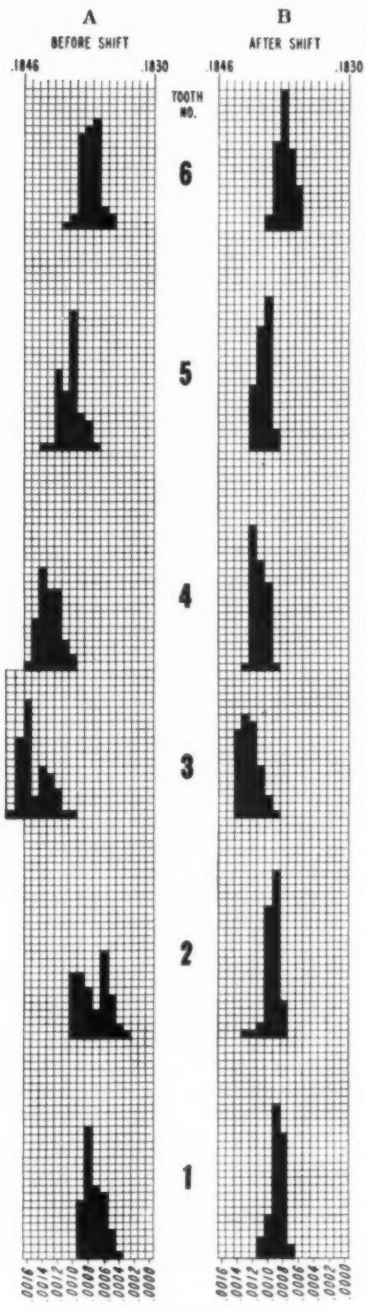
Our former practice was to hob the splines, using precision-ground spline hobs. But to obtain the necessary accuracy and surface smoothness was not easy, because the maximum allowable accumulated error in width of splines is only 0.0016 in. and concentricity must be held to within 0.002 in.

All machining operations at Maytag are carried on under continuous quality control. Any divergence from tolerance specifications calls for an immediate shutdown of the equipment responsible until the cause is located and remedied.

No Longer Generated

When it became necessary to step up output, we decided to investigate other methods of producing the splines. We found the answer in form-cutting instead of generating the splines, using Michigan Tool Company's Shear-Speed gear shapers.

We were doubtful at first that a machine primarily intended for fast pre-cutting of gears (prior to



Before shifting the tool cage, the teeth are running a little closer together on one side of the spline. After the shift, all tooth spacings are within control limits

gear shaving) could give us "finished" parts to close limits. However, output is close to 300 pcs per hour per machine—and to tolerances consistently closer than previously obtained.

In the Shear-Speed machine, all spline teeth are cut at the same time by individual form tools arranged in a circle in the cutting head, and the work is reciprocated axially. Each time the spline reciprocates, the blades are fed radially inward.

Regardless of how accurately machines and tools are made, minute errors do creep in somewhere along the line. Ability to compensate for such errors is therefore of advantage.

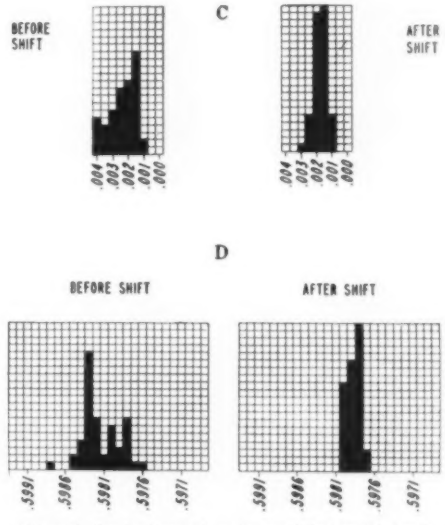
In the Shear Speed, the cutting blades are located sideways by the tool cage. Radial location and feed of the blades is controlled by the feed cone. Individual blades cannot be adjusted sideways, but the cage carrying the tools can be adjusted in any direction horizontally. The effect of this adjustment—controlled by four setscrews—is to enable accurate balancing of variations in tooth spacing.

A common condition in gear or spline cutting is shown at *A* on charts. Width variations per tooth are not great, but fall in different ranges. Splines 3 and 4 are on the high side, while splines 1 and 2 are toward the low side. When this happens the entire tool is shifted a few tenths in the proper direction to "line up" the variations. Since tooth 3 is running too 'wide" by a few tenths, we shift the tool cage toward the tooth.

Setup Errors Overcome

The result of the shift is shown at *B*. Tooth-spacing variations are now "in line" with each other, and spacing deviations between different spline shafts have been simultaneously reduced. What we have done by shifting the tool cage is to compensate for minor machine and setup errors by accurately establishing the true center relationship of feed cone, tool cage, blades and spline shaft during the cut.

Concentricity of root dia and OD is improved as shown at *C*, while at *D* it will be seen that variation of root diameter at the No. 1 space is only a few tenths as against the 0.0096 in. total allowable.



Although the feed cone is not moved during the tooth-spacing adjustment, improvement occurs in respect to concentricity of the root diameter to OD and variation in root diameter at the No. 1 space

IF you have a multi-story plant...

IF you must handle thousands of items, many in small lots...

IF your routings vary and you need flexibility in handling...

THEN you will want to read how, in one New England plant...

PLANNED HANDLING LICKS BUILDING

SACO - LOWELL'S handling problems are similar to those of many companies occupying multi-story buildings constructed without regard to modern methods of internal plant transportation. Material must be moved between buildings and often to several different floors. Floor loadings are limited and storage space is scarce. The problem is further complicated by the fact that production lots often are small and there is great variety in the size, shape, weight, and routing of parts.

The solution to these problems, however, demonstrates that standard mechanical equipment, properly applied, will do much to overcome natural building handicaps. While many problems yet remain, Saco-Lowell today has an in-plant transportation system that has eliminated a tremendous amount of manual handling, and has been an important factor in maintaining production schedules throughout the plant.

One Main Dispatch Area

Basically, the system breaks down into four major phases: relatively long hauls between buildings or terminals, vertical transportation by elevator, storage operations on each building floor, and intra-departmental handling. The first phase is planned as a tractor-train operation between five terminals. Four are located near existing elevators giving access to manufacturing floors; the fifth is at the plant foundry from which a great many parts originate. Of these terminals, Biddeford No. 1 is the main dispatching area, and all trains go to this point without regard to the ultimate destination of the material. Trains then are broken up, and are re-made according to destination.

Material for manufacturing departments in the Biddeford plant is loaded so each trailer contains only material routed to a given manufacturing floor adjacent to one of the Biddeford terminals. Material for the Saco plant, however, is sent directly to Saco No. 1 Terminal and, at that area, is assembled into trailer-loads according to floor destination.

By centralizing between-terminal dispatching, the danger of duplicate trips with only partially-loaded trains is held to a minimum. Full loads insure low-cost hauling and, as all material containers have a pallet base, the operation of reloading trailers is a fast, fork-truck job. One terminal operator, with one fork truck and driver, is assigned to each of the main terminals, Biddeford No. 1 and Saco No. 1.

Vertical Transportation

At each terminal, trailers are pulled onto the elevator by a hand-guided tractor that rides on the elevator at all times. Four trailers are taken at once, with the size of the trailer (8x3) having been selected to get maximum utilization of the elevator floor area.

As the elevator can bottleneck the entire system, a definite procedure is followed to minimize lost time. All deliveries are made first. Then pickups are made of outgoing trailers loaded with parts ready for operations on other floors. Initially, these had to be returned to the terminal for consolidation into full loads before delivery. At present, however, the system has been in effect long enough so the operator can deliver trailers between floors without confusion and without falling behind on the elevator workload. All elevators are reserved for material handling only, and no passengers are permitted.

Departmental Storage

Near each elevator on each floor is a storage area where incoming trailers are unloaded by fork truck and reloaded with out-going material. Floor-load limits are low and must be watched continuously, but stacking three pallet-boxes high is feasible for most jobs. Fork trucks are limited to those of 2000 or 4000 lb capacity with emphasis on maneuverability. One fork truck is assigned to each floor and works primarily at the storage area, although it also may be called upon for some moving jobs within the department.

Many parts can be carried in pallet boxes and a $32\times24\times17\frac{1}{2}$ in. (outside dimension) box is the size best suited to the majority of pieces and lot-sizes processed. Originally, a larger box was employed, but often was not filled. The smaller box thus saves storage space and also is easier to move around machine workareas. Furthermore, it seldom exceeds 2,000 lb in weight.

Intra-Departmental Moves

For moving to and around machines, pallet movers, both manual and powered, are employed widely. After fork trucks remove loads from storage, the pallet movers take over and have been found ideal for moving through the tight

BY MATERIALS HANDLING SECTION
Methods & Equipment Dept.
SACO-LOWELL SHOPS
BIDDEFORD, MAINE.

HANDICAPS

spaces that often exist around machines in production departments.

Within the department in which it is now operating, the Semaphore System shows considerable promise and probably will be extended to other production departments. It eliminates the need for operators seeking out truckers and is very helpful to the trucker in showing where his services are required.

For work on which pallet boxes are not suitable, numerous other containers are employed. Gear blanks, for example, are stacked on posts mounted on a round base that can simply be rolled from machine to machine. Another large casting, called a Sampson, is transported in a pallet rack. Within the machining department, this is placed on a four-wheel dolly that can be pushed around readily. However, in so far as possible, the objective is to use standard containers and to avoid special pallets and racks.

Please turn page

Dispatching—Biddeford No. 1 terminal is main dispatching area for plant. In-process parts and all castings from plant foundry are moved by trailer from this terminal either to Biddeford sub-terminals or to Saco No. 1 terminal. Fork truck loads containers on trailers.

Over-the-Distance—Tractor train travels from Terminal No. 1 to any one of three other terminals. Made up at Terminal 1, train has material only for manufacturing departments served by terminal at destination. Trailers are standard for the plant

HANDLING FLEET MORE THAN TRIPLES IN THREE YEARS

	TOTAL UNITS IN OPERATION PRIOR TO 1947	DURING 1950
POWERED UNITS:		
Fork Trucks	4	38
Walkie Powered Stackers	0	14
Walkie Powered Pallet Movers	0	13
Walkie Powered Tractors	0	12
Platform Lift Trucks	8	1
Platform Trucks:	0	6
(five are messenger express trucks)		
Tractors	13	10
Dump, Van, Panel, and Platform Trucks	5	9
Automobiles	0	5
Scoop Tractors	0	4
Powered Sweeping Units	0	2
	30	114
NON-POWERED UNITS:		
Trailers: 8' x 3'		329
Trailers: Special		81
Manual Pallet Movers		26
		436
CONTAINERS:		
Tote Boxes		20,000
Pallet Boxes		17,000
Pallet Crates		1,000
Pallets		15,000
		53,000

On Elevator—Trailers are moved by small hand-guided tractor to elevator at terminal area. Size was planned so four trailers plus tractor will fit in elevator

Off Elevator—Tractor pulls trailers to In-station next to elevator on each manufacturing floor. Deliveries are made on upward trip; out-bound trailers are picked up as elevator descends

All operators of equipment must attend operators' training school and a driver's badge is issued upon satisfactory completion of the course. This badge is worn at all times and has a picture of the type of equipment that the operator is qualified to drive. The operator also is responsible for making out a daily check of equipment.

Maintenance of Equipment

Operation of the system depends upon keeping the wheels rolling, and to do this requires an excellent maintenance section. At Saco-Lowell, a Preventive Maintenance Program is used with the maintenance force working on a three-shift basis. Preventive maintenance checks are made after 60 and 300 hours of operation and follow a detailed breakdown on standard check forms. Two vehicles are assigned to the garage to replace those being checked. Five trailers are checked daily.

Costs Are Recorded

An average operating cost record has been established for each vehicle by the following method: Labor, which is recorded on an indirect labor ticket, plus expenditures for parts and material, is divided by the actual operating hours of the vehicle. With this system a monthly check is made and excessive costs are investigated.

Why the System Works Well

For all moves up to those within the manufacturing departments themselves, the basic unit of transportation is the trailer. This then is nicely integrated with fork-truck operations by use of the pallet, or a pallet-base container throughout the plant. By assigning fork trucks to terminals and to individual manufacturing floors, they normally travel only over short distances and work primarily on the operations for which they are best suited—lifting and stacking. For the long distance, tractor trains provide efficient, low-cost movement. Centralized dispatching insures a minimum of cross-hauling and lightly loaded trips.

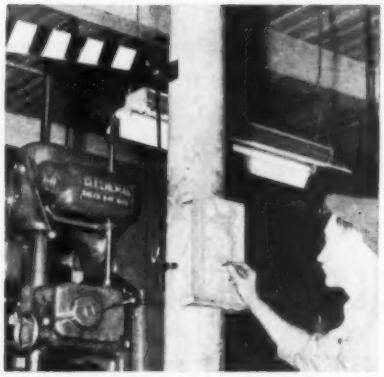
A similar purpose is accomplished by loading trailers according to manufacturing departments. This does much to insure elevators carrying a full load each trip and, together with the system of delivery, minimizes lost time in elevator operation, thus avoiding bottlenecks in vertical transportation. The trailers also eliminate the need of a fork truck riding the elevators; the hand-guided tractor is a light-weight and relatively inexpensive piece of equipment that has worked out very well in this application.

Originally set up between 1947-48, this system converted Saco-Lowell from what previously had been primarily a manual handling operation. Introduction of this system was one of eight major steps in modernization of the company's manufacturing facilities. Management realized that without an organized handling system, and adequate mechanical equipment, material could not be moved through the plant fast enough to meet production schedules.

Powered Units Increased

When installing this system, Saco-Lowell, at one time, had as many as 14 materials-handling engineers to work out the details of material flow, routing, loading on equipment, containers for the tremendous variety of odd sizes and shapes required for the textile machinery manufactured by the company, and standardization of methods and equipment. From 1947 until 1950 the company increased its handling fleet from 30 to 114 powered units, with a detailed breakdown presented in an accompanying table. Today, the operation of this fleet overcomes the handicap of old buildings and provides a regular flow of parts and material to all areas of the shop.

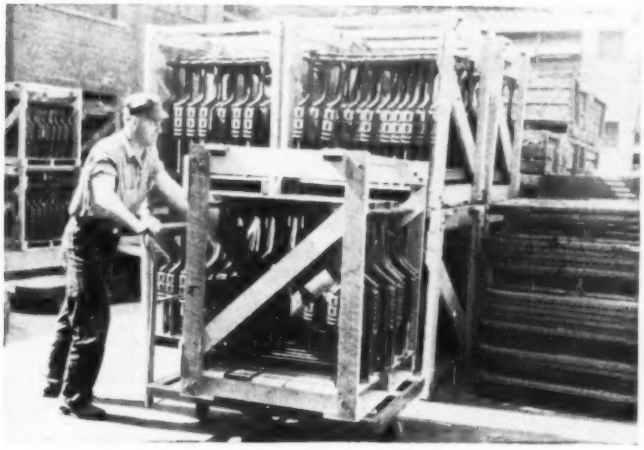
At the Manufacturing Floor—Fork truck operates in storage area to remove incoming material from trailers and to load outbound pallets and boxes. Truck also removes loads from stack as they are needed for production



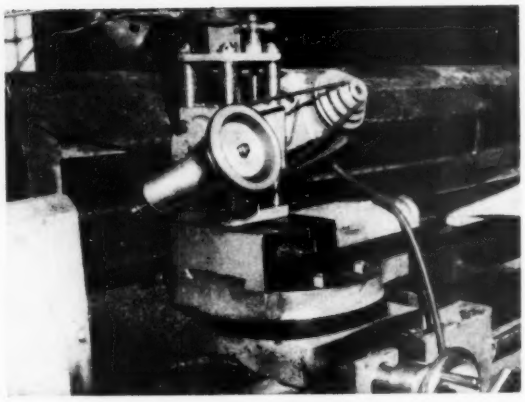
Semaphore System—When operator needs trucker, he sets semaphore and inserts peg in board which has photostat of section of model plant layout to show where material is

To Machines—Pallet movers make majority of intra-departmental moves, carrying material to operators, and machined parts back to storage area. Semaphore system, being tried in one department, automatically tells trucker when he is needed

▲ **Conveyorized Assembly**—Start of section of roller conveyor on which condensers are assembled progressively. Frame is assembled on baseplates, then hoisted onto pallet for movement down line



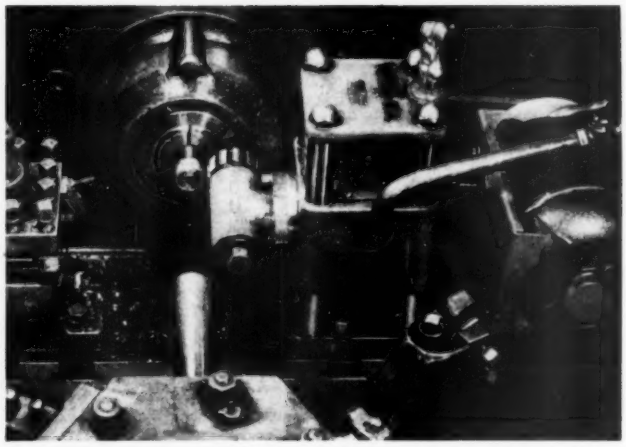
◀ **Special Dolly**—Wheeled dolly and open-side pallet rack were developed so one man can move large castings, called Samsons, between machines. Formerly, two men were needed for large, heavy trailers



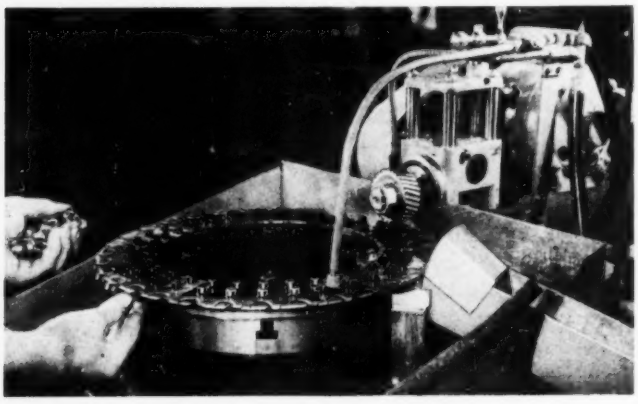
Avoided: special machine or tedious setup on planer or miller. Esso's Bayway Refinery puts 20-ft long, 16-in. dia oil-skimmer tubes in large lathe, fastens Versa-Mil attachment with high-speed cutting head to lathe carriage. Job: to mill each flame-cut edge of slot to 22½°, or included angle within slot to 45°

GET QUICKER ACTION WITH ATTACHMENTS

MACHINE-TOOL deliveries are slow; special-purpose equipment requires engineering effort that is sorely needed on defense orders. The manufacturer of armament or civilian goods can avoid delays, and often expense, by applying attachments to existing machines or by combining attachments with a locally built dial-feed table, etc., to form a special-purpose unit. By following these steps he can often get an extra operation at practically the cost of one, and accuracy is not impaired by a change of setup. Examples that illustrate these points are from Versa-Mil Company, New York, but the imaginative shop man will be able to effect economies in production time and cost by adapting other kinds of attachments too.



Extra Operation: Warner & Swasey turret lathe performs series of conventional operations upon high-speed steel roll at Berger Machine Products, Inc., Maspeth, N. Y. Versa-Mil mounted on rear of cross-slide thread mills part, avoiding second handling and setup. Total time on piece reduced to approximately one-third of that previously required

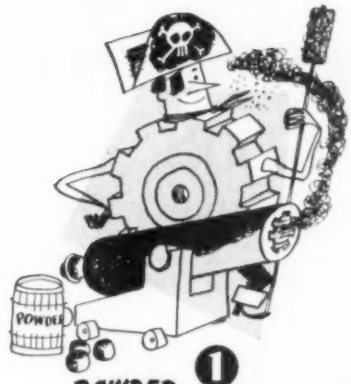


Special Machine: Immediate requirements for more milling capacity to square the ends of thread inserts were met by Heli-Coil Corp., Long Island City, N. Y., by building a special machine. Components of machine are: motor-driven rotary table plus fixture and No. 1 Versa-Mil mounted on discarded drill press table. Parts are climb milled to allow automatic ejection. This special unit eliminated need to purchase milling machines and released existing equipment to other work

FIVE WAYS TO FORM GEARS

Many readers will remember the days when cast-iron gears were painstakingly finished by hand filing. They ran well under heavy loads at low speeds, but tooth form and gear shape left something to be desired. Modern demands for silence, speed, and efficiency require exact tooth forms in most cases.

Five processes, in addition to cutting (of cast, forged, or fabricated blanks) and stamping, are used to produce precision gears. Each of the five solves one or more production problems—cost, unmachinable material, complex shape, or the like. Two of these processes were described at the recent 35th Annual Meeting of the American Gear Manufacturers Association, and the authors have consented to publication of extracts. Material on the other three has been drawn from the makers and users, in accord with our usual practice.



1 POWDER METALLURGY

2 CASTING

3 EXTRUSION

4 COLD DRAWING

5 PLASTIC MOLDING

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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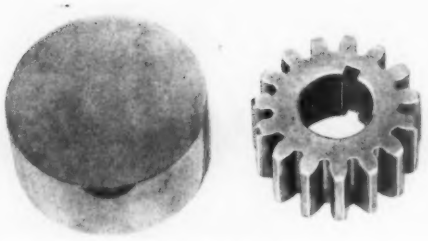
POWDER-METAL GEARS

Unexpectedly high tooth strengths have recently been attained by impregnating powder-metal gears, so applications are rapidly broadening. In this report, digested from their paper at the AGMA Annual Meeting, the authors have added points brought up in discussion and amplified experience data to include latest examples. Applications, relative costs, tolerances, and manufacturing hints are included



Test Pinion—Because of high die cost, pinions (right) for life tests (as an aid to design) are cut from a powder-metal blank (left). The blank must be the same alloy, compacted to the same density. If density and material are constant, molded gears will have better strength than this test piece, so a slight factor of safety (10 to 25%) is provided

By D. W. LYNCH, T. J. SNODGRASS and T. T. WOODSON, GENERAL ELECTRIC CO., BRIDGEPORT, CONN.

The *art* of powder metallurgy is not new. The ancient Egyptians were well versed in this art and produced forged tools from powdered sponge iron. But powder metallurgy did not become a *science* until some 5000 years later.

In the early 19th century, Wollaston put the art on a scientific basis with his production of ductile platinum from sponge platinum powder. Not until the 20th century was powder metallurgy anything more than a "last resort" process—as in the familiar production of tungsten filaments for incandescent lamps.

In the era of World War I, powder metallurgy was employed to produce bearings and other shapes with unique properties: built-in lubrication, porosity, and so forth. Very recently (about the last decade) powdered metals began to compete as structural parts; the last few years, great strides have been made in the application of powdered metal to the production of structural parts and to gears in particular.

LIMITING TOLERANCES FOR VARIOUS GEAR-MANFACTURING PROCESSES

PROCESS	DEGREE * OF CARE	TOOTH-TO-TOOTH SPACING	CONCENTRICITY Full indicator	PROFILE Inv. Var.	HELIX	COMPOSITE CHECK Total Tooth Error	TOOTH THICKNESS	TOOTH SURFACE FINISH
SINTERING	**Assumed size of part: 0 to 1½ in. dia, 0 to ¾ in. face width, 10 to 32 DP**							
	Commercial	.0007	.0025	.0005	.0007	.003	.001	45
SINTERING	**Assumed size of part: 1½ to 4 in. dia, 0 to 1 in. face width, 10 to 20 DP**							
	Commercial	.001	.004	.001	.0007	.004	.002	45
STAMPING	**Assumed size of part: 0 to 1 in. dia, 0 to 1/16 in. face width, 20 to 128 DP**							
	Commercial	.001	.003	.001	.0005	.004	.001	128
EXTRUDING	**Assumed size of part: 0 to ½ in. dia, 0 to ¼ in. face width, 20 to 128 DP**							
	Commercial	.001	.005	.002	.001	.007	.001	64
HOBBING	**Assumed size of part: 0 to 6 in. dia, 0 to 1 in. face width, 20 to 126 DP**							
	Commercial	.0005	.003	.001	.001	.0035	.002	63
	Precision	.0003	.002	.0006	.0005	.0025	.001	32
	Very best	.0002	.001	.0004	.0003	.0012	.0005	16
GRINDING	**Assumed size of part: 0 to 8 in. dia, 0 to 1 in. face width, 8 to 64 DP**							
	Commercial	.0005	.002	.001	.0005	.0025	.0015	40
	Precision	.0003	.0012	.0004	.0003	.0015	.001	25
	Very best	.0002	.0006	.0003	.0001	.001	.0003	10

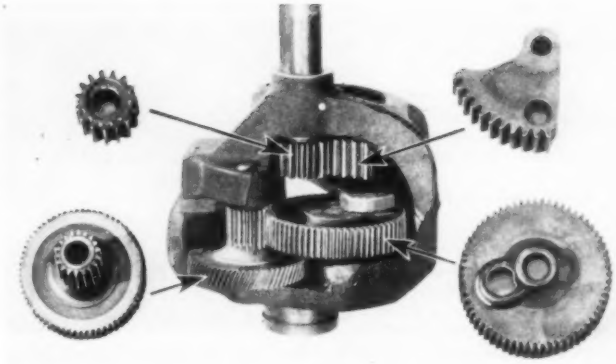
* Commercial—Quality obtainable in good job shops
Precision—Quality obtainable with new or first-class machine tools and precision tooling
Very best—Quality at 25 to 50% extra cost. Best tools and personnel

Process:

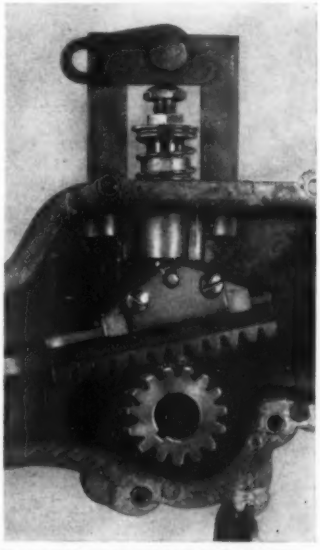
In the powder-metallurgy process as applied to gear manufacture, fine (325-mesh) metal powders are compacted under great pressure (20-60 tons per sq in.) in suitable dies. The so-called "green" compact or briquette is then heated to a temperature close to, but below, its melting point, and the compacted powder coalesces. This operation is called sintering and is carried out in very carefully controlled atmosphere furnaces. During this step, the compact, structurally quite weak as pressed, increases greatly in strength because of bonding of the compressed powder. Economically, this is the best point to consider the compact a finished part. With the standard (93% Fe, 7% Cu) powdered iron (ASTM-B222-47T) a tensile strength of 35,000 psi is obtained at this point. Elongation and impact strength are low because the pores still present in the part act as stress raisers. Additional operations may be employed to increase these properties. Coining (cold working) is a common method, followed by resintering. This may be repeated, the part getting denser and stronger with each treatment. The most promising method to date of improving the properties of sintered parts is through use of molten-metal infiltration or impregnation. In one commercial process, a slug of a lower-melting alloy, such as copper, is placed in contact with the sintered iron part and is heated in a reducing atmosphere until the slug melts and is absorbed by the sintered part. This process is aided greatly by capillary action of the porous structure of sintered metals and also by molten copper's great fluidity and wetting quality. By this method the tensile strength of 93% Fe, 7% Cu can be more than doubled and the impact strength quadrupled.

Process Limitations

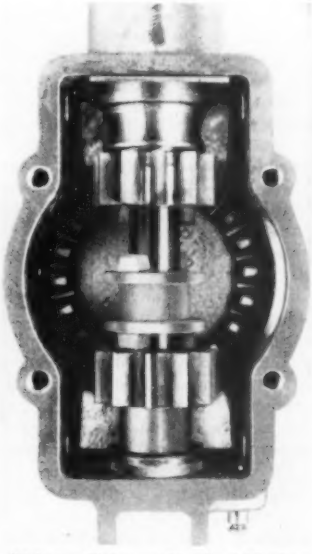
Dimensional Errors — Powder-metal gears are subject to certain dimensional manufacturing errors. The first three listed below are common to both conventional gears and sintered gears, although they arise from different sources.



Automatic Washer Gear Train—A rotor shaft drives the dual gear through the helical teeth. Spur teeth on the dual gear drive the crank gear which, through the crank, moves the sector back and forth to oscillate the agitator pinion and thus the agitator in the clothes basket. All these gears are high-carbon, copper-impregnated iron (C 1%, Cu 15-20, bal Fe). They were first made of pearlitic malleable cast iron (Z metal) except for a C1137 steel pinion. Standard sintered iron (low carbon, Cu 7%, bal Fe) was tried, but the higher-strength heat-treatable iron was found necessary for wear and strength. Helical teeth on the dual gear are cut, because of withdrawal problems. Stresses on these gear teeth are calculated as 70,000 psi. Over-all savings by shifting from cut malleable iron to sintered impregnated gears was over 50%. Exact figures are impossible because high-production methods were not used on cut gears, except on the agitator pinion, where shift to powder metal saved 60%



Rack Pinion from Standard Washer —This is similar to the agitator pinion in the automatic, but includes impact loading when the moving rack engages the agitator pinion without a clutch. This gear was cut from C1137 steel, and the changeover to sintered iron saved 60%



Wringer Pinion on Standard Washer —Two clutch dogs molded on one side of this gear engage a hardened-steel clutch. The gear was originally cut from C1115 steel and case-hardened, is now compacted in high-strength material and the dogs induction-hardened for wear resistance

The last four are unique in powder-metal gears because of the process:

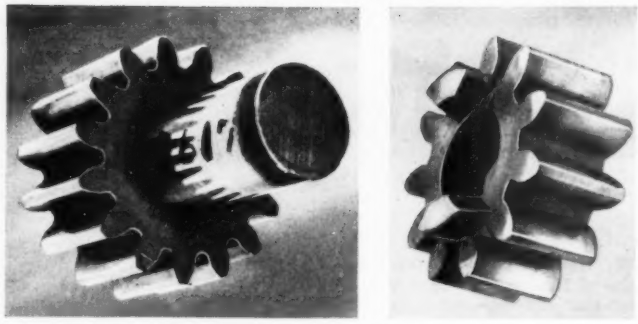
Error	Usual Causes
PD not concentric	Play in molding tools due to wear
PD too large	Die barrel worn
Tooth chordal distance too large	Die barrel worn
Tooth face taper	Die barrel wear always greater at the top than at the bottom
PD not round (pear-shaped), etc.	Uneven shrinkage because of unsymmetrical blank
Tooth-tooth spacing uneven	Uneven shrinkage, different powder densities, incorrect powder feed into mold
Tooth face not parallel to bore	All reasons given above

Of course, gears all reflect errors in improperly made tools, whether strictly profile errors or just excessive play between barrel and stripper or stripper and pin. Conversely, all the gears are uniform when made from good tools coupled with good molding and sintering practice.

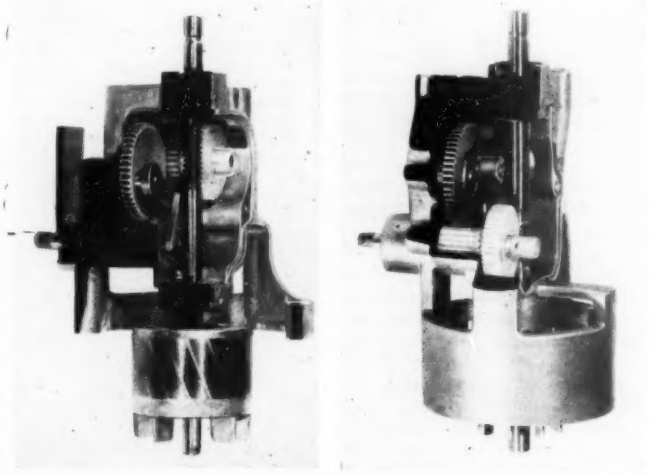
Shape — Molding or briquetting tools limit the variety of shapes possible in powder-metal gears. Of course, subsequent machining or deforming operations are possible, but generally, powder-metal gears are made in "single-draw" tools only (single pressure axis—no reentrant surfaces). Typical shapes are blanks with rims or hubs molded integrally. Face notches or interruptions can be molded in if they are not major masses. Of course, the maximum advantage occurs when a gear has a non-symmetrical outline. Here the cost is usually 1/2 or 1/3 that of a cast or cut gear.

Tooth shape depends on the method of tool production. Customarily, a set of broaches is prepared by form-grinding the teeth in a "milling machine" setup so undercut is not possible. These broaches cut the die barrel. A "stripper" similar to a broach is ground for forming the ejecting floor of the cavity. Ordinarily the broaches are kept on hand for making future die barrels.

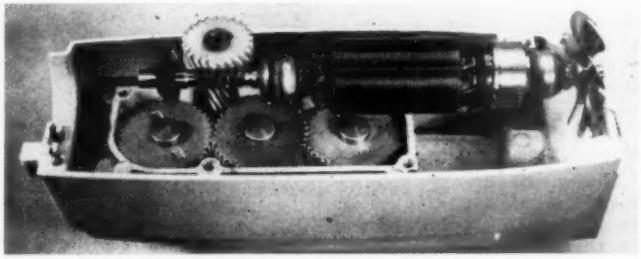
The tooth root is made a pure radius by some tool vendors because of the fragility of the wheel



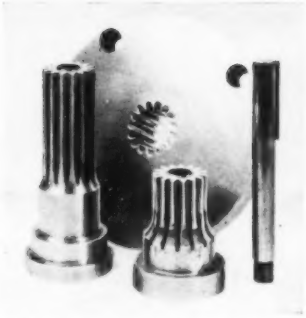
Rack and Wringer-Head Pinions—After a successful overload life test, these pinions show only burnishing of the teeth. Copper-impregnated gears "run in" very well, polishing but showing almost no wear, while machined-steel gears wear and gall on these applications. Apparently, the heterogeneous surface, presence of copper, and higher apparent hardness help the sintered gear



10- and 12-in Fan Gear Cases—In both cases, a worm drives the molded-nylon helical gear which in turn drives the crank gear through the spur end of the nylon gear to oscillate the fan. The nylon gear in the 10-in. fan is molded in one piece, while the spur and helical nylon gears in the 12-in. fan are separate. Crank gears are standard sintered iron because it is lowest in cost for the job



Food-Mixer Motor-Gear Assembly—A 25,000-rpm rotor drives a textolite helical gear, which drives two, side, sintered-iron gears. All three later gears drive beaters. As in fan-gear trains, plastic gears are mainly for noise reduction

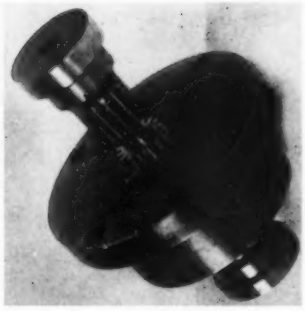


Basic Parts of Powder-Metal Tooling—Die barrel at rear, with stripper, plunger, and pin in front. The die barrel is cut by a broach, also used to make replacement dies. Stripper and plunger teeth are ground

and general difficulty when grinding a conventional 3-radius root. Otherwise, the teeth (flanks and OD) are supplied in conventional form.

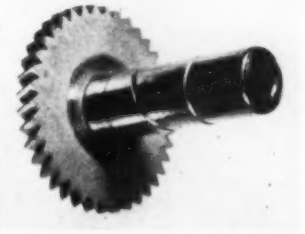
Size—The range of sizes manufacturable depends on the strength of the tools (punches) in the small sizes and the capacity of the presses in the large sizes. High-strength gears (85,000 psi) from 3/16-in. dia up to 3½-in. dia have been made, the latter using a 300-ton press to briquette the green part. Of course, web perforations would allow the same area to be enlarged to a greater pitch diameter. In the medium and larger sizes, about 30 tons per sq in. exposed area is required for briquetting. The thickness of the blank (tooth face) is comparatively unimportant as far as molding goes; it counts mainly when warpage may distort the tooth flank and prevent adequate uniformity of contact. In addition, thin blanks (less than 3/32 in.) are difficult to strip from the mold without injury to teeth, and excessively heavy sections may have low density because of briquetting pressure loss from excessive wall friction. The diametral pitches have varied from 40 to 10.

Teeth can be molded in the hub of a dual gear with optimum strength obtained by blending the flanks and root with the hub for minimum stress concentration. No other method of making accurate metal gears can yield such geometry. Simple gears can be made



Die Assembly—In operation, stripper is in position near bottom of barrel and powder is poured in over it to fill cavity, then swept level. Plunger moves down as stripper moves up, thereby applying pressure from both ends. Plunger backs off, and stripper ejects briquette, ready for sintering

Fan Gears—Sintered gears (left), and cut gears they replaced. The sintered fan gear at top left (12-in. fan) has integrally molded hub and steel-pin insert, costs 65% less than the cut brass gear at right with screw-machined hub and steel-pin insert. The sintered gear at lower left (10-in. fan) costs 50% less than its machined counterpart at right



Helical Mixer Gear—Here a helical gear is pressed in sintered iron; in contrast to our usual procedure of using spur gears or cutting helical teeth because of molding difficulties. Special rotating dies are used in pressing to form dense teeth and to avoid stripping them when the compact is removed

with helical teeth molded in. Of course, splines, keyways, and double-D bores can be molded in when the concentricity tolerance of about 0.005 in. TIR can be accepted. Round bores are frequently bored or ground with respect to the pitchline, in a pin-chuck, for optimum concentricity after sintering.

Strength—Usual base materials are brass or iron. In the original first sintered condition, these materials have inherent strengths sufficient only for low-duty gearing such as timing devices, toys, or small appliances, as shown in the table.

Typical commercial sintered metal mechanical properties:

	Tensile Strength, psi	Elongation, % / 1 in.
Alloy A (Fe+7¼% Cu)	35,000	0.8
Alloy B (Fe+1% C)	35,000	0.8
Alloy C (Fe)	20,000	15.0
Alloy D (80-20 Brass)	30,000	20.0

Elongation is obtained through the use of the more expensive iron powders, so a premium is paid for this property. By suitable extra processes, properties can be considerably increased, as previously described. Properties of the impregnated iron gears are:

Typical copper-impregnated sintered iron mechanical properties

	Tensile Strength, psi	Elongation, % / 1 in.
Alloy A (above) Cu impregnated	70,000	1
Alloy B (above) Cu impregnated	85,000	1
Alloy C (above) Cu impregnated	60,000	20

Quantity—The minimum economic quantity cannot arbitrarily be stated, but varies with the cost of other methods, performance advantages, consistency of quality, and availability. For a typical 1-in.-dia gear, the tools might cost $2000. Thus, for a production run of 20,000, the tool component of cost would be ten cents per gear, which might be reasonable. For a complicated 3-in.-dia high-strength gear whose tool cost (including broaches) might be $10,000, a minimum run of 50,000 would make the cost of the dies not more than 20 cents per gear.

Heavy-duty gears in the above sizes, in 100,000 lots, have been manufactured to sell at surprisingly low prices, about 12 cents for the 1-in. size and 60 cents for the 3-in. size. Light-duty gears run as low as 2.5 cents for a 1-in. size.

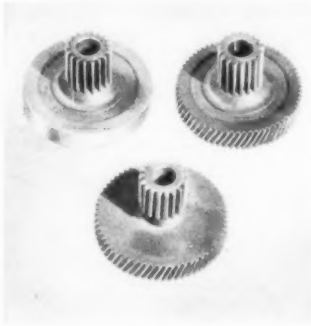
Process Advantages

Costs—The prime point of gain in powder-metal gears is the labor or time of tooth formation. In most applications, the gear is passed through a press just once, and at a rate of perhaps 2 to 15 sec per gear. In most cases, the press can be set on automatic operation, requiring manpower only to fill the powder hopper, take away trays of green briquettes, occasionally gage the pieces, etc. Sintering is done in a conveyorized furnace, as are other treatments, such as further metal impregnation or steam or oil treatments. There is almost no scrap loss in this process, and as a result, even the relatively high cost of most metal powders does not appear as a high piece price. Iron powder ranges in price from 8 cents for Swedish Iron to more than $2 per pound for carbonyl iron.

Selective Properties—By powder-metal techniques, some unusual results can be achieved. Selective impregnation, teeth only, for instance has been mentioned. Further effects are possible, such as lamination of different powders poured into the same mold (i.e., adding a thin bronze clutch face integrally to one side). Also differences in porosity can be created if desired for special lubrication needs. Carbon can be added uniformly or selectively for general or local improvements of properties. Brazing may be done either during the sintering operation, or later.

As a part of selective properties, selective hardening can be performed. Similar to induction tooth hardening in conventional gears, localized induction hardening has been applied, as previously described to high-carbon (1%) powder-metal gears. Strength and abrasion resistance are notably improved, although the exact mechanism and metallurgy are not fully understood. (The alloy content of iron powder is so low that the

Nine Sintered Gears for Appliances—Largest is the 3.25-in. PD crank gear at top left, with about 7 sq in. area normal to the pressure axis, so it requires at least a 250-ton press (at 30 tons per sq in.). By contrast, the little fan gear at bottom center has only 1 sq in. area normal to the pressure axis, so can be produced with ease on a high-speed 50-ton press. Largest tooth is on the 9-pitch wringer-head pinion at center, the smallest on the 40-DP fan spin gear (10-in. fan) at bottom center



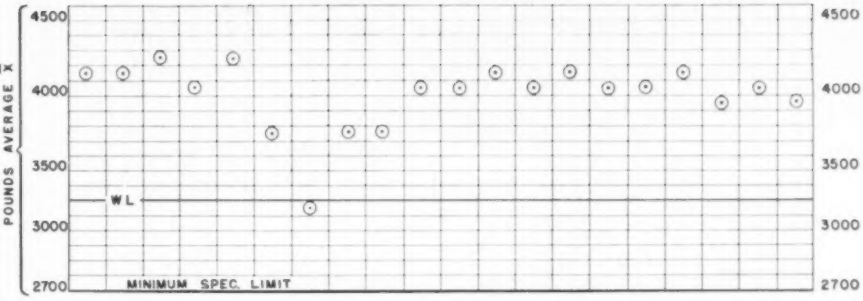
Dual Gear for Automatic Washer—At bottom center is the original gear machined from pearlitic malleable iron, at top left the sintered blank, and at top right the finished sintered gear. A combination of helical and spur gears cannot be molded, so one must be cut. The 18 spur teeth are molded to 20 DP, 20° PA, and 0.9 in. PD. The 65 helical cut teeth have 25°RH helix, 26 DP, 20° PA and 2.835 in. OD

Control Clutch for Automatic Washer—Complicated combinations of shapes can be obtained in a single molded piece. Here control cams and gear teeth were molded, but the "C"-ring undercut below the teeth was machined. Undercuts are not possible in single-pressure-axis powder metallurgy

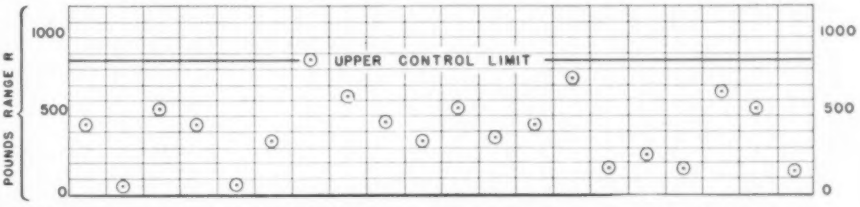
LABORATORY
QUALITY CONTROL CHART

PRODUCT RACK PINION (L-4166171) VENDOR
CHARACTERISTIC TOOTH SHEAR STRENGTH (LBS.) INSPECTION SPECIAL TEST FIXTURE

POUNDS AVERAGE $\bar{X}$

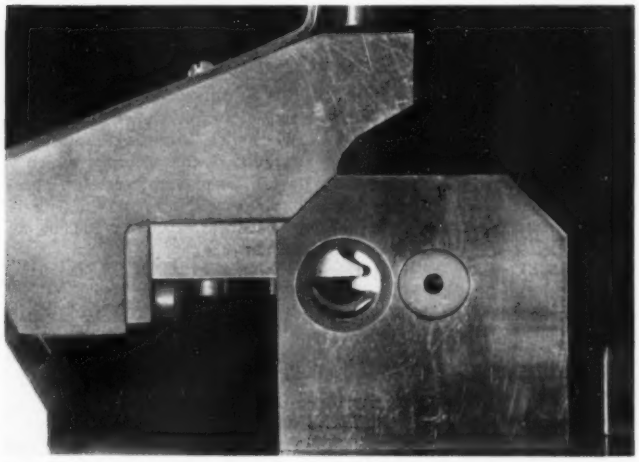


POUNDS RANGE R



LOT SIZE		6453	6406	3152	4008	2838	5930	2714	1642	3725	4896	6291	2885	10052	4558	8102	8105	4320	6000	2500	8250	
SAMPLE MEASUREMENTS	1	4365	4100	3910	4240	4260	3680	3150	3820	3585	4200	4400	4000	3850	4540	3920	3980	4050	4300	4140	4060	
	2	3950	4150	4475	4150	4210	3425	3450	3890	4020	4100	3800	3980	4200	4110	3980	4120	4100	3800	3720	4000	
	3	4245	4120	4320	4140	4180	3680	2570	3710	3560	3980	3930	4300	3870	3810	4110	4190	4225	3860	4240	3980	
	4	4000	4125	4330	3630	4200	3750	3330	3290	3600	3890	4080	4150	4270	4325	4060	4090	4115	3650	4060	3950	
	5																					
TOTALS		16560	16495	17035	18360	16850	14535	12500	14710	14765	16170	16270	16410	16190	16785	16050	16380	16490	15010	16160	15990	
$\bar{X}$		4140	4124	4258	4090	4212	3633	3125	3677	3691	4042	4067	4102	4047	4196	4012	4095	4122	3902	4040	3997	
R		415	50	565	410	80	325	880	600	480	310	520	340	420	720	190	230	175	650	520	110	
DATE REC'D		2/10/49	3/2/49	3/15/49	3/22/49	4/15/49	5/6/49	8/30/49	8/30/49	9/25/49	11/18/49	12/2/49	1/25/50	2/2/50	3/23/50	6/2/50	6/12/50	10/3/50	10/19/50	10/30/50	11/17/50	
TESTED BY:		PP	PP	JC	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP	BP	RK	RK	AM	AM	AM	AM	

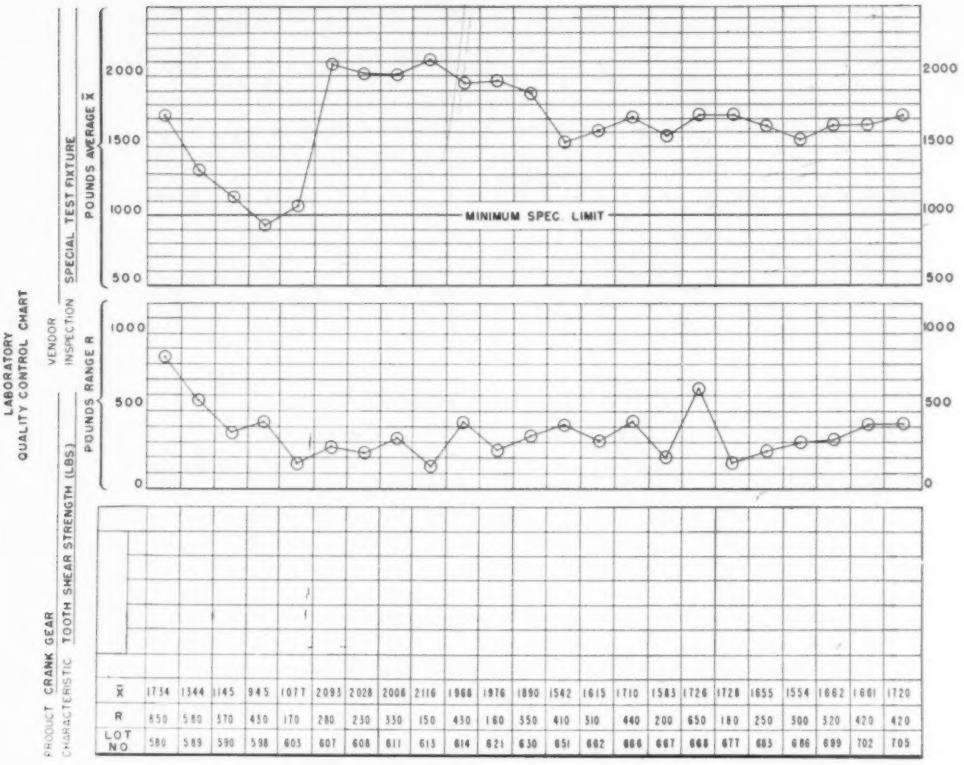
Quality Control Chart for Rack Pinion—This chart lists results of strength tests, lot by lot for a representative number of lots. Four gears are tested by shearing off a tooth in a standard fixture. Average breaking load is listed as X, and range from highest to lowest load as R. For average breaking load, there is a minimum specification limit below which gears cannot be used, and a warning limit (WL) below which the vendor is merely notified



Strength Test of Pinion—Teeth are loaded at pitch line and sheared off. Breaking load is recorded on the quality-control chart

Strength Test of Pinion Over Rolls—No special fixture is used. The part is set thus in a press for the test

QUALITY CONTROL CHART ON A CRANK GEAR



X̄	1734	1344	1145	945	1077	2093	2028	2006	2116	1968	1976	1890	1542	1615	1710	1583	1726	1728	1655	1554	1662	1661	1720
R	850	580	570	450	170	280	230	330	150	430	160	350	410	510	440	200	650	180	250	300	320	420	420
LOT NO	580	589	590	598	603	607	608	611	613	614	621	630	051	662	666	667	668	677	683	686	699	702	705

hardenability is quite poor.) Hardness, measured by ordinary indentation methods, does not describe properly or adequately the metallurgical change.

Inherent in the molding process is the production of good tooth surface finish. Tools are lapped to a mirror finish to minimize wall friction. The resulting gear teeth can be made smooth to a few microinches. No other single machining process can approach it. Combinations of hobbing and shaving or grinding and lapping would otherwise be required.

Quality Control

One of the big problems in the use of powdered metals is quality control. How can you test for mechanical properties? Since the structure is quite heterogeneous and inherently porous, hardness is not a good criterion. Only the finished part is available, no original stock to go back to for tensile strength, elongation, etc. As a result, the best method for testing quality is a destructive test of the part itself. In the case of gears, the method we commonly use is to measure the shear strength of teeth in a tensile machine.

This is the method of testing sintered iron structural parts specified in ASTM Spec B222-47T. Samples are taken on a quality-control basis and are tested in a fixture which loads a tooth evenly at the pitch diameter. The breaking load is then recorded on a quality control chart. The minimum allowable tooth strength taken in this manner varies from 1000 lb for the automatic washer crank gear tooth to 2700 lb for the standard washer rack pinion. In actual practice the strengths vary from close to the minimum to almost twice that value. This is particularly true of copper-impregnated gears. On unimpregnated gears of similar dimensions the value would be lower but more consistent. The gears are also inspected on a quality control basis for dimensional accuracy. The gear tolerances shown in the lead table under "sintering" are representative of the accuracy which is now reached commercially, causing a scrap loss of only 1% or so in quantities exceeding 100,000 per year.

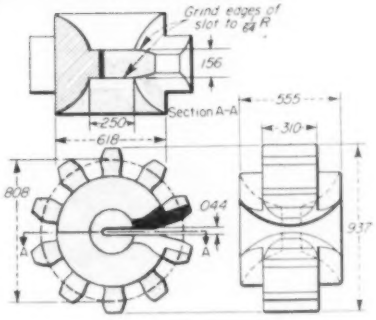
Summary

Powder-metal gears, as a result of developments of the last few years, can handle many low- and medium-duty jobs. Primary advantages are simple, high-production methods for complicated shapes. Under proper process and quality control, performance and cost figures may both be improved.

Wire-twister gear, which mates with a rack, investment-cast on a production basis by Haynes Stellite—the only one thus made. Gears for pickling tanks have been similarly cast

CAST METAL GEARS

Sand, permanent-mold, shell-mold, die, and investment castings have all been used, but new—and still secret—casting methods show great promise. Intricate shapes and "unmachinable" materials are investment-cast. Close tooth tolerances are difficult and costly to achieve by casting



Oldest—and potentially the newest—among forming processes for tooth production is casting. Cast gears, finished by painstaking hand chipping and filing, were among the first types and certainly the standard method for making large, slow-speed mill gears. Cast-steel gears are still standard for large diameters—but nowadays teeth are cut; modern tolerances are usually too close to make sand casting practical.

Shell molding and several other new casting methods are currently being tried for gears, and reports are that some show great promise, offering tolerances in quantity production within a thousandth or less. These methods are still under development, however, and little information is forthcoming beyond the fact that they are more precise and considerably cheaper than investment casting—in fact have possibilities of competing with gear cutting.

Die Casting

Zinc, aluminum, and brass die castings are being made in spur, bevel, and other gear forms, particularly for instruments, cameras, business machines, washing-machine gear pumps, small speed reducers, and lawnmowers. Die-cast gears are specified when large quantities enable high die costs to be amortized. Such gears are not used at high speeds or heavy tooth loading. Good concentricity, tooth spacing, surface finish for the above applications are obtained because the accuracy is built into the tools. When face width approaches or exceeds ¼ in., some draft or taper is usually required to allow for removal of the piece from the die. In such cases, it is essential that the flash trimming die also broach or shave the teeth.

Spur gears, as made by one shop, normally range from 4 to 6 in. pitch diameter, but smaller sizes are produced. Bevels are smaller than the range cited but are heavier. If gears must be run at higher speeds than normal for die-cast products, the bore consists of a steel or bronze insert.

Brass provides the strongest die-cast gears. But if the application demands both accuracy and strength, it is best to cut the teeth.

Investment Casting

Limited numbers of gears have been made by investment casting, where the material required was difficult to machine, complex in shape, or with too high a melting point for die casting. The process is very accurate compared to more familiar casting methods, but not compared to precision machining. Usual accuracies specified are ± 0.005 in. per linear inch on large pieces up to about 5 in. wide, ± 0.003 in. on pieces under ¾ in., with angular tolerances to ± 0.5°. Gears have been cast, however, with precision steel molds for the patterns, to ± 0.001 in. on tooth dimensions and ± 0.25° on angularity.

Wax, plastic (generally more accurate), and frozen mercury (larger pieces) have all been used as pattern materials, and some types of gears are being made successfully, one being that pictured here. However, the process seems most applicable in gear making where one or a few gears, particularly of intricate design or unmachinable material, are involved. If finish-machining is to be done, usual allowances are from 0.010 in. on small gears to 0.040 on large ones. As-cast surface finishes are normally 70 to 80 mu-in., rms, but with plastic patterns this has been cut to 20 mu-in., rms.

Strengths of investment-cast gears usually range midway between the longitudinal and transverse values for rolled bars of the same material, 10% or so above the properties of sand castings. Even tool steel and nitriding steels can be cast, but must be annealed for machining. AISI 3140, heat-treated, will give a tensile up to 220,500 psi, heat-treated 420 stainless to 120,000 psi, Monel H or S to 120,000 psi and a hardness of R_c30. Aluminum-bronze gives about 85,000 psi and can be heat-treated to R_c90. Beryllium copper, heat-treated, about 170,000 psi.

Data courtesy International Nickel Co.; Haynes Stellite Div.; Union Carbide & Carbon Corp.; Doehler-Jarvis Die Casting Corp.; Sperry Gyroscope Company.

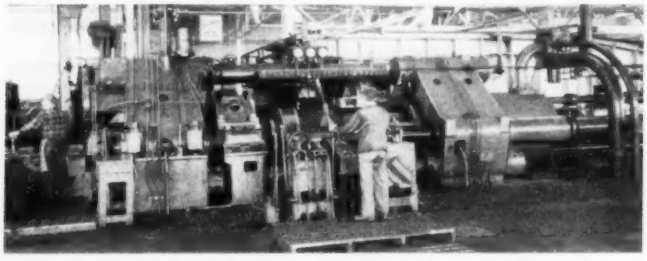
TYPICAL EXTRUDED SECTIONS

Number Teeth	Outside Diameter	Pitch Diameter	Root Diameter	Pitch	Tooth Thickness
18	1.241	——	0.972	16	0.098
7	1.487	1.062	0.775	6	0.261
8	0.985	0.800	0.544	10	0.157
7	1.430	——	0.712	6	0.261
15	2.020	——	1.588	8	0.1963
9	1.325	——	0.920	14	0.196
16	1.285	——	0.985	15	0.112
8[1]	1.150	——	0.750	Tolerance =	0.010
12[2]	1.8	1.5		8 CP =	0.3927
11[1]	1.8	——		1.265 hole drawn to	1.215
6	Segment for Easy washer, body 0.720, radii 1/32 in.				
12[3]	5.25	4.438	3.625	Tolerance =	± 0.034

— Data courtesy The American Brass Company, except for final gear, from Reynolds Metals Company. [1]Drawn. [2]Drawn to 1.75 in. [3]Aluminum.

EXTRUDED GEAR STOCK

Clock and instrument makers are major users of brass pinion and cam stock, which runs against stamped gears or racks of similar materials. Aluminum alloys can also be extruded in gear shapes



2300-ton Schloemann extrusion press of the type used for brass at the New Toronto, Ont., plant of Anaconda American Brass, Ltd.

SPECIAL cross-sections, such as pinions and cams, can be extruded in copper, brass, bronze, and some nickel-silver and phosphor-bronze alloys for cutting to length and machining of hubs, collars, and the like in screw machines and turret lathes. Aluminum alloys can be extruded in similar shapes, and undoubtedly will be, as the use of stamped aluminum-alloy gears increases. Such sections are "commercially constant in cross-section, thereby eliminating considerable machining. These rods have a higher tensile strength, smoother surface free of pits and porosity, sharp and clean edges, and a denser grain structure than sand castings. They are readily machined, have a smooth surface, and can be easily polished or plated,"—according to American Brass Company.

Some extruded bars are cold-drawn afterwards for harder surfaces and more exact cross-section. Smaller diameters and a wider range of alloys are also available. Either drawn or extruded stock may be gripped in special collets like that shown under "Cold-Drawn Gears," or when pitch is small can use standard round collets. Special collets are also required for segment shapes or pinions with eccentric machining or holes.

Most commonly extruded materials are Naval brass (Cu 60, Zn 39.25, Sb 0.75) and extruded architectural bronze (Cu 56, Zn 41.5, Pb 2.5). Desirable tooth form is involute rather than cycloidal; some typical tooth forms are shown in the silhouettes, plus commoner sizes. While extruded shapes below 1 in. dia were formerly made, presently available ones (new business) are between 1- and 2-in. diameters. Smaller sizes are made by cold-drawing rod.

Cost of tooling (hardened steel) for extrusion is generally estimated to be amortized at roughly a cent a pound. Press capacities limit section weight to about 180 lb in brass. The aluminum gear sketched was not made, but is included to show that section characteristics are like those of brass. Area would be 15.455 sq in., weight per foot about 18.55 lb, depending on the alloy.

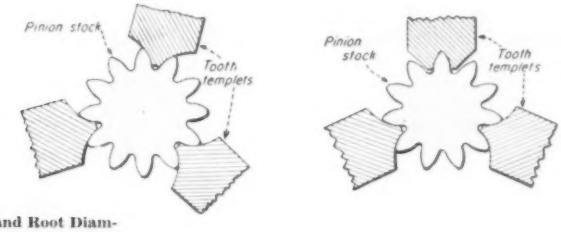
COLD-DRAWN PINIONS AND SMALL GEARS

Process akin to wire-drawing provides rod in many materials, with hard skin that resists wear, at low cost in quantity

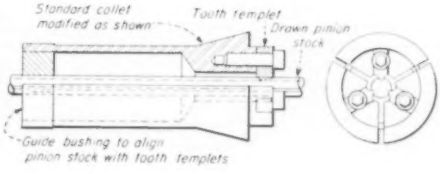
COLD-DRAWING, like injection molding, produces a dense, cold-worked surface with high durability, accurate enough so no machining of the drawn shape is required. The process is adaptable to any drawable material, which includes not only aluminum alloys, brasses, and bronzes, but also most steels (including high-carbon and some stainless alloys) silver, beryllium copper, nickel and its alloys, copper and its alloys. With certain limitations in tooth form, cold-drawn rod can be finished at high production rates in screw machines, producing pinions and small gears with collars or shanks, drilled holes, and the like. Thus cold-drawn gears are used in watches, clocks, business machines, motion-picture projectors, carburetors, magnetos, small motors, switches, timers, telephone and scale mechanisms, cameras, appliances, toys, and similar units.

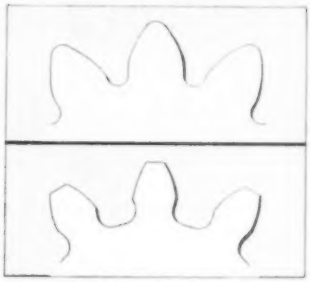
Accuracies of cold-drawn rod are claimed to be as high as those of cut teeth, with higher durability and load-carrying capacity if the material has good cold-working properties. This is because cold drawing produces compressive stresses which increase working strength of the teeth and gives a smooth, hardened surface. Tooth form and dimensional accuracy are also claimed greater than for extruded rod. In AISI 1112 steel, for example, the surface of a 0.55-in., 12-tooth pinion had a Vickers hardness number of 270, dropping to 180 at the core, while that of a similar cut pinion was 182 at the surface, 168 at the core. These correspond to 126,500 psi tensile for the drawn pinion, 85,000 psi for the cut one. In phosphor bronze, the cold-drawn pinion was 235 at the tooth tip, 165 at the core, as compared with 175 and 150 for a cut pinion.

In durability tests, cold-drawn pinions showed over 200% gain. In such tests, greater surface hardness is supplemented by the higher surface finish of cold-drawn stock, ranging from 10 to 30 mu-in. rms.

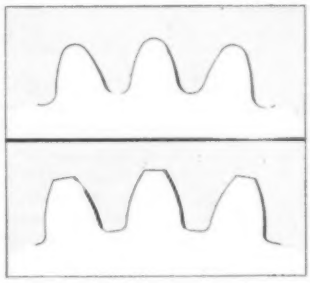


OD, PD, and Root Diameter are concentric within close limits, so any of the three can be used as locating surfaces in machining cold-drawn rod. This collet is modified to locate on tooth profiles, thus reducing required grip because of the keying and avoiding damage to tooth tops


Standard collet modified as shown
Tooth templet
Drawn pinion stock
Guide bushing to align pinion stock with tooth templets



For cold-drawing, the 11-tooth pinion below is enlarged by the AGMA-ASA standard to the form above, avoiding undercut and providing radiused rather than sharp corners



Similar modification of a 40-tooth gear, applying full-radius form

Also, cold-drawing requires quality material, and tends to show hidden defects in the metal. Not only involute and cycloidal gear forms can be produced, but also ratchets, sectors, cam-shaped and non-circular gears. Tooling is moderate, and use of such stock presupposes quantities that permit low writeoff.

Tooth form must be modified for best results in cold-drawing. The ASA 20° Involute Fine-Pitch System (B6-7-1950) can be used, except that teeth are made with full radius at tip and root to avoid tearing. Excessively thin, deep teeth are not recommended, nor are undercut involute pinions, particularly in materials with poor drawing properties.

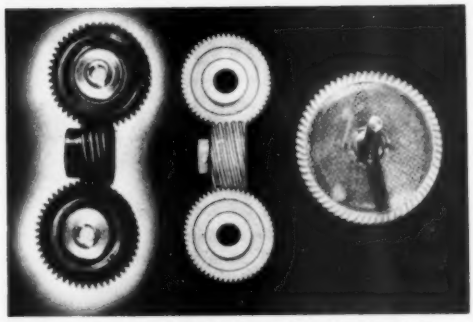
Cold-drawn pinion rod has shown savings of as high as ten to one over cut pinions, averages three to five times cheaper. Durability ranges from five to seven times greater.

Data courtesy Rathbone Corporation, Palmer, Mass.

MOLDED PLASTIC GEARS

Several plastics can be molded to close tolerances, particularly nylon. Here, digested from his recent AGMA paper, Mr. Zumstein lists these materials, shows products and applications, gives design and production suggestions

BY FRED R. ZUMSTEIN, Plastics Machine Division, THE FELLOWS GEAR SHAPER COMPANY



Projector Gears — Cellulose - acetate - butyrate (black, at left) worm-driven helical gears have replaced nylon (right) in a projector at reduced cost, although the nylon gears ran continuously under test friction load of 2 in.-lb at 100 rpm. For light loads, gears can be thin, but heavier cross-section helps conduct heat from tooth surfaces

LAMINATED and certain cotton-filled phenol-formaldehyde plastics (thermosetting) have long been used in silent gearing. Those types require compression-molded blanks which, because of lengthy time cycles and large-platen presses, do not result in an effective production-cost reduction. In addition, this type of gear requires complete machining from blank to finished teeth. Latest production methods with thermoplastic materials show considerable cost savings by injection molding with fast cycles in permanent steel molds. Construction of the molds in some cases allows for a gear to be molded complete with teeth and degated from sprue and runner. Further, scrap pieces, excess runners, and sprues can be reground and reused, cutting storage space and material costs. Further discussion will be confined to thermoplastics with heat - distortion points (ASTM D648-45T) below 400 F.

Recent improvements by material manufacturers have centered on higher heat resistance. Commercial polystyrene plastic materials[a] have shown much improvement along these lines. The polystyrenes are lowest in cost @ 35¢ per lb. Dimensional consistency or stability over a wide humidity range not only makes these materials outstanding among thermoplastics, but also permits them to compete with the phenolics in spite of a slight material cost disadvantage. On textile machines, for example, where high humidities required wider tolerances with other plastics, polystyrene-counter-wheeled magnetic counters are in use, capable of 1,000 counts per minute. Here, the specific gravity of 1.05 allows high speed with lower inertia loads.

Heat-resistant cellulose acetate (180 F) materials in the high acetyl[b] form or low-plasticizer, hard-flow types[c] have been recommended for small precision parts. A life test on a worm drive and helical gear on such a cellulosic material, run dry and without dissimilar materials, gave unexpectedly favorable results. An automobile manufacturer molded from a single-cavity die test samples for speedometer driven gears which worked excellently below 180 F. Investigation of this tough thermoplastic for small gears in a lower-temperature zone (below 180 F) would seem to justify further study because of low manufacturing costs.

A majority of thermoplastic gear applications today appear to favor the use of polyamide materials, more commonly called nylon[d]. Unlimited applications are imaginable, according to this statement by a Naval Research Laboratory: "Nylon thread is stronger than steel wire . . . Tests indicate a tensile strength of as much as 225,000 psi, whereas steel wire of the same size seldom shows as much tensile strength as 150,000 psi." Perhaps this analogy cannot yet be used in reference to heavier-section parts, but the fact remains that with proper orientation (as through a spinnerette in thread production) by injection molding or by post treatment, strength values can be improved today on molded parts.

Nylon gears are at present in food mixers, projectors, cameras, business machines, fishing reels, lawn sprinklers, hydraulic pressure gages, automotive speedometer

(a) Koppers Co.-Polystyrene P-8,Monsanto-Lustrex and Cerex, Dow Chemical Styron 671
(b) Hercules Powder Co.
(c) Tennessee-Eastman Co., Kingsport, Tenn. H_6 flow.
(d) du Pont Co., Polychemicals Division, Wilmington, Del.

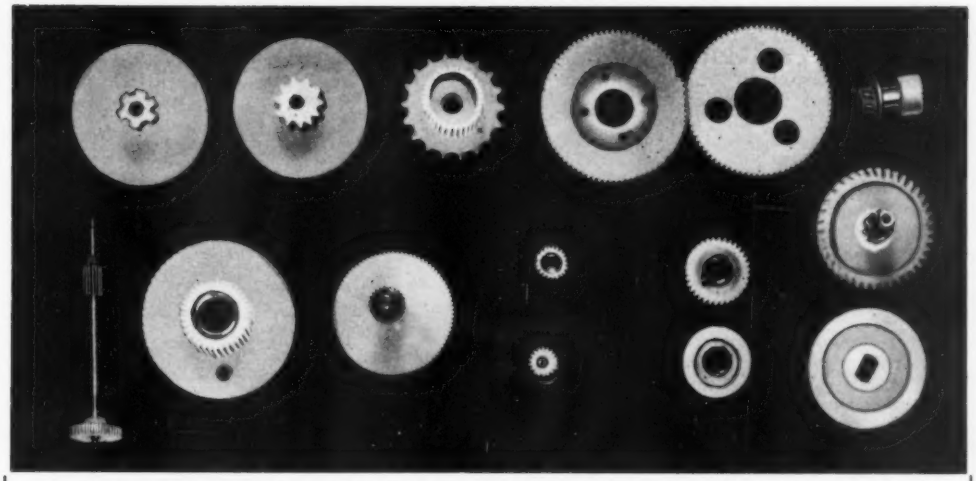
Nylon Safe Working Stresses

(Static stress Factor = 6000 psi)

Pitch-line Velocity, fpm	Nylon FM-10001	Pitch-line Velocity, fpm	Nylon FM-10001
100	4500	1000	2250
150	4071	1500	2029
200	3750	2000	1909
250	3500	2500	1833
400	3000	3000	1781
500	2786	4000	1715
800	2400		

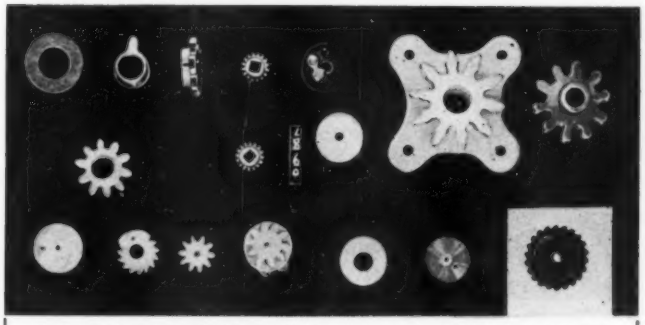
Based on MIT formula: Velocity factor $= \frac{150}{200 + PLV} + 0.25$. As the equivalent for metal Gears is $\frac{600}{600 + PLV}$, velocity factor for non-metallic gears is higher at speeds above 1000 fpm. Nylon tensile strength is 10,530 psi at room temperature, according to duPont (ASTM D638-44T). Flexural fatigue tests (ASTM D671-49T) show 6000 psi for nylon FM-10001. These values are used in the Lewis formula:

$$Hp = \frac{9.5 \times 10^{-5} \times SWS \times FW \times PLV}{DP}$$



Camera Gears—Top row (left) shows front and rear of a combination face and pinion gear with splined hub. It drives the Brownie movie camera shutter and film-take-up assembly, and replaced cut or shaved gears held to ±0.001 TIR. Next it is a one-piece sprocket and gear, and at right a 78-t, 48-p set of gears molded at one-third previous cost for the RCA 16-mm projector. At 1440 rpm, dry, they outwear steel three times.

Lower-row gears are machined from nylon blanks to ±0.002 TIR by Revere Camera. At left is a shutter shaft with nylon gear pressed on (54 t, 96 p, 20° PA, 15° helix); a 1-piece cluster gear with bronze bearing (pinion: 36t, 48p, 14½° PA; gear: 58t, 48p, 14½° PA, 45° helix); a steel pinion and nylon gear, shutter drive gear (18t, 64p, 20° PA); and shutter pinion (21t, 64p, 14½° PA); injection-molded blank with steel insert and complete engaging cam gear (34t, 48p, 14½° PA), in which the steel insert takes load of a locknut and drives a phenolic and steel gear at 960 rpm; blank on a steel shaft, and a small face gear (21t, 64p, 14½° PA)



Cash registers and calculators—In the upper row by National Cash Register, in the lower by Monroe Calculator. At top left is a 10t, 12p, 14½° PA nylon pinion and the 3-part steel pinion it replaced. Although the plastic material cost 10% more, the plastic gear cost only 10% as much as the steel. Next is a 16t, 48p, 20° PA nylon gear which showed 1/3 the wear and ¼ the torque limit of the steel gear above it, sufficient for normal use. But when paper "ball-up" occurs in a cash register, operators usually force the gear train to eject it, and if this gear were to break, field disassembly of 1200 parts is necessary to repair it, so the application was rejected. Next in line is a counter wheel which costs 46% as much as the steel one, gave a life test of 12 million cycles, three times expected machine life. At extreme right is a 10t, 12p, 14½° PA steel gear which is to be replaced by nylon at 50% of the cost. Beside it is a 20t nylon adapter for an aluminum cash-register dial. This is a skip-tooth design to permit a pawl to locate it in ten positions. It failed from the high-inertia load when the dial returned to zero. A possible answer would be a steel insert at that location.

Counting cams, ratchets and gears in the lower row have made considerable savings. Counting dials can be made in 4 operations instead of 33 for steel, saving 67%.

gears and electric windshield-wiper gears, washing machines, and home temperature indicators. First application of nylon at Eastman Kodak was in the smallest bevel gear ever made. Nylon has the highest heat resistance among the lower-priced thermoplastic materials, thereby dominates in these applications. Even-higher-heat-resistant materials are available; among these a trifluoro-chloro-ethelyne (Kel-F) at approximately $14 per pound.

Design Considerations

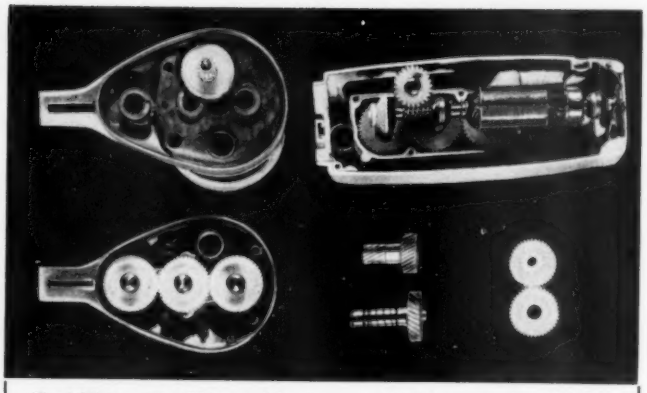
Application of plastic materials to any industrial part required a study of the physical dimensions of the part. One case in point was a small polystyrene gear. An allowance of a few more thousandths wall thickness between the OD and hub would have reduced development of mold cavities to weeks instead of years. However, this increased wall section would have necessitated relocation of several instrument parts. This could have been considered at the beginning of the project in the development

engineering level, without consequent production pitfalls because of inadequate coring, thin wall sections, sharp corners, etc.

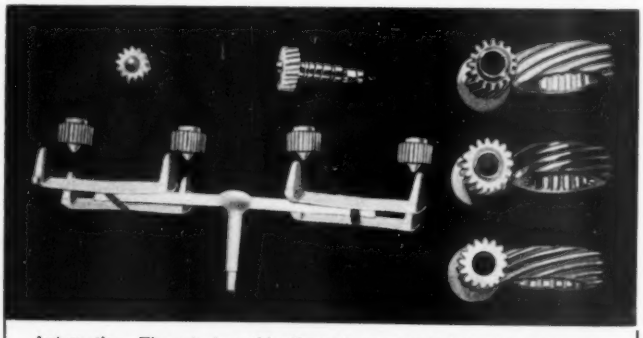
In the less-rigid thermoplastic gears, such as nylon, resiliency absorbs the inevitable inaccuracies of cut gears. The self-lubricating characteristic (as in plain nylon bearings in textile equipment) offsets friction of mating gear-tooth surfaces. Nylon passes the property which Louis Martin of Eastman Kodak has dubbed "conformability"—the ability to deform slightly to improve mating and absorb shock when run with a steel pinion.

Theoretically, plastic and steel gears deflect similar amounts when subjected to loads proportional to their moduli of elasticity—a tooth in a plastic gear under 1-psi load will deflect as much as a similar steel tooth under 75 psi. We can determine horsepower loads based on the strength of a single tooth from the Lewis formula with the safe working stress factors given in the accompanying table. Rigid metal gears with slight inaccuracies of tooth form and spacing may create high dynamic loads which have to be carried by a single tooth. The resiliency of nylon plastic, however, may allow, under load conditions, contact of two or more teeth. Consequently, computations from the Lewis formula will be conservative.

Tooth wear on plastic gears is effected by relative sliding of gear-tooth surfaces, excessive compressive stress at progressive points of contact, and cutting the flank of the driving tooth by the tip of the entering tooth. In the case of a nylon driving pinion mated with a steel gear, it is relieved of this undue wear by using the all-addendum form on the pinion, thus reducing the angle of approach and eliminating the trochoidal path of the tip of the entering tooth. Tooth strength is thereby increased 50 to 75%. This procedure is more desirable than the modified tip of the steel-driven gear tooth which would reduce tooth-contact duration and would not remove tendency to interference. When plastic-driven gears are considered, these modifications are necessary only in the sense of eliminating excessive undercut. In all cases of



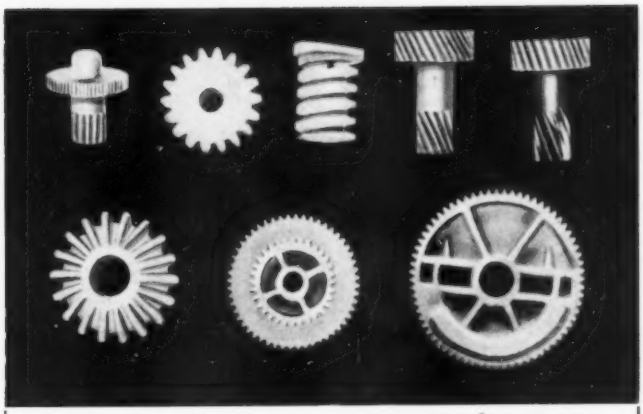
Food Mixers—The GE assembly at upper right has a 24t, 32np, 20° PA, 33° + LH helix gear on a steel shaft. The 12t, 32p, 30° PA, 24° + LH helix pinion drives three beaters through a phenolic and two sintered-iron gears and is strong enough to withstand loading to stall the motor. Now a complete plastic pinion and gear are being considered. The second mixer assembly (left) is now under field test. The clustergear (56t, 48p, 30° PA, 20° + RH helix) may have to be redesigned to reduce excessive wear from the right-angle drive. The three 42t, 32p, 30° PA gears in the lower housing are working very well. Gear at center (29t, 1.18 pd, 20° PA, 19½° RH helix) is molded for Westinghouse of Canada. The gear cavity is cast in beryllium copper. At lower right are a pair of gears from an early food mixer. Mold-cavity inserts were hubbed and incorporated a draft angle. Original PA was 14½°, but this was changed to 18°45' to allow for shrinkage



Automotive—Three test combinations of worm and pinion for a governor drive are shown at right. Nylon parts were cut from bar, but worn in slowly to get the glossy surface of an injection-molded part. All tests are run dry. At top is nylon worm and steel pinion, the latter hardened to 400 Bhn and polished. Under accelerated load test, this combination worked very well and showed no sign of fracture under overload. The brass worm and nylon pinion were least satisfactory, because brass has some affinity for nylon which causes excessive wear. (National Cash had similar difficulties with nylon and aluminum spur-gear combinations; nylon becomes a lap by picking up particles from lubricant or air to accelerate wear.) Apparently, nylon must be used with steel or stainless rather than a non-ferrous material. The all-nylon combination has run over 65,000 miles dry with very satisfactory results, although the nylon actually would absorb oil from an oil bath to facilitate operation.

At top center is a nylon speedometer driven gear molded on a knurled-steel shaft by Ford, made for 50% less than laminated phenolic gears with machined teeth. This gear withstood 100,000-mile runs at 80 mph and 250 F heat in a Pikes Peak test.

The other gear is a speedometer driven unit. By center gating, concentricity is held to 0.002 instead of the 0.003 attained by molding on a shaft, but assembly costs more



Appliances—Top left is a cluster gear for an oscillating fan, next the control gear and worm which assemble by molded-in slot and key, and food-mixer pinions of solid nylon and nylon with steel insert. At lower left is a bevel gear for a wringer-type washer, a mixer gear cored to save material, and an automotive electric windshield-wiper control gear (68t, 32np, 18° 45° PA) with cam face

a steel versus nylon wear surface, the best condition is with a highly polished, hardened-steel pinion.

Nylon gears have the low heat conductivity of 1.7 Btu/hr/sq ft/°-F/in. Experimental gears have been made with copper shims to facilitate conduction of the heat from the gear-tooth area to prevent undue wear and deformation from the heat generated at this point. Thus, in more critical cases of gear design where the favorable silent wear characteristics of nylon may be desired, a gear blank or insert could be used in the mold with a thin cross-section of plastic molded over the surface of the insert. The problem of heat dissipation can then be minimized while increasing the beam strength with a metal insert. Such "tires" of nylon molded over steel have been tested by Eastman Kodak. Success or failure of any plastic-gear application can be determined with a certain amount of accuracy. However, other considerations may arise in service, such as temperature variations causing excessive interference, requiring dimensional change.

In cameras, projectors, and fishing reels, nylon gear applications have been extensive for either one or both of two reasons: One, silent operating, self-lubricating characteristics. Two, cost savings by injection molding a complete cluster or original assembly of separate parts. In a Shakespeare fishing reel, the spool pinion (20t, 53.-2509p, 24° PA, 12° + RH helix) and drive gear (77t, 53.2509 p, 24° PA, 12° + LH helix) have been cut from injection-molded blanks for several years. Here the requirement for silent operation with high pitch-line velocity is essential.

An indirect use of plastics in gears is in the precision investment casting field. Here, injection-molded patterns of polystyrene have been used for the cast (alloy steel) gears in wire-twisting equipment. Expanding applications in this field are just now developing in producing jet-engine-blade airfoils. The plastic patterns are more accurate for reproduction than the older wax methods.

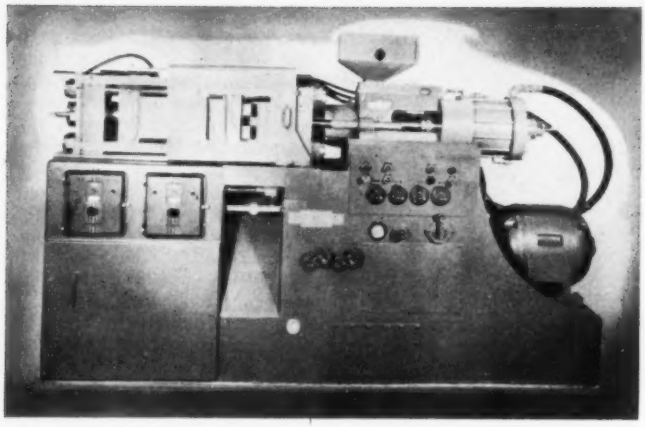
Production Methods

The greatest cost-saving factor in production of thermoplastic gears is that the complete gear is produced in one operation in a permanent steel mold. Conversion is by heat and pressure from a granulated state in the homogeneous mass. A multitude of factors affect quality of this molded part which can be controlled in the first phase of conversion through the machine. Most injection machines today have automatic controls for time, temperature, pressure and rate of injection. These machines range from 1 to 300 oz per shot. A great percentage of the small-part production, however, is being confined to 8-oz and smaller machines that can be operated on automatic cycles. Smaller machines with small molds represent lower investment in capital equipment to achieve high production.

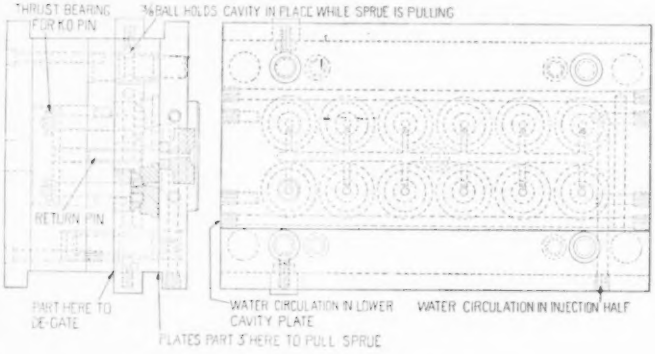
Inasmuch as the problem in this converting operation is one of thermodynamics, 24-hr production is recommended. Temperatures range in the heating cylinder between 400 and 600 F and are controlled by accurate temperature controllers. Pressure on the granular stage of plasticized material will range up to 20,000 psi. The time cycle in injection molding is relatively fast, being in the average range of 100 cycles per hour on 8-oz machines to as rapid as 600 per hour on the small machines. Cycle speeds are generally controlled by the quality required of the molded part. In gears, for example, molded in nylon with cross-sections not greater than ¼ in., cycles in the neighborhood of 60 to 80 per hour could be estimated.

Prior to molding, plastic materials should be controlled in moisture content and consistency of granulation, in percentage of reground material and fines. Humidity also affects size control in precision manufacture. Variation in cycle speed will result in variation of heating of the plastic in the chamber and in cooling of it in the mold, further affecting size. Cutting-oil vapor in the air, if concentrated, will come in contact with nylon through hot-air blowers used in preheating, and will cause discoloration, but no other harm.

Consideration should be given in design of the injection mold for adequate temperature control somewhere below the heat-distortion point of the material. Mold temperatures will range from the refrigerated types to approximately 200 F and should be controlled within 5 F over the entire mold surface. This will maintain a definite shrinkage factor for the material, which is required to main-



Typical Injection Molder—Material passes from the heating cylinder into permanent steel molds. In these mold sets or bases, small steel inserts are retained and are sealed off by clamping pressures of the press end of the injection machine, rated in tons. This is a Fellows machine, introduced in 1936


THRUST BEARING FOR KO PIN
BALL HOLDS CAVITY IN PLACE WHILE SPRUE IS PULLING
RETURN PIN
PART HERE TO DE-GATE
WATER CIRCULATION IN LOWER CAVITY PLATE
WATER CIRCULATION IN INJECTION HALF
PLATES PART 3 HERE TO PULL SPRUE

Center-gated, automatic degating mold for small gears. Mold is water cooled and is designed to pull the sprue and then break off the gate automatically

tain uniform production. Nylon shrinks in molding about 0.012 in./in., so mold proportions must allow for this. For example, shrinkage in tooth length would be greater than in width, so the mold cannot be of true involute form. Further, nylon absorbs moisture or oil, and expands as a result—a 2-in. gear at 100% humidity and elevated temperature expanded about 0.001 in./in. This is frequently a highly desirable property in nylon gears because it tends to make them self-lubricating.

In flowing around a core pin, a fine weld line is inevitable and may constitute the effect of a shrink mark on the OD of the molded article. For this reason, close temperature control must be maintained in the mold to minimize this effect. Center-gating will also minimize it.

Consistent production and close temperature control are mandatory in producing accurate molded parts. By injection molding the complete gear, a consistent result can be maintained on critical dimensions once the shrinkage factor has been established. Here is a record from a production run of 15 consecutive shots, showing slight variations from shot to shot. These parts were checked from a single cavity of a speedometer-gear mold:

Cycles	OD	Overpin Dim	Root Dia	Hole
1	.711	.7655	.533	.3051
2	.710	.7644	.5315	.3051
3	.7105	.7643	.5325	.305
4	.710	.7645	.532	.305
5	.7115	.7655	.533	.3051
6	.710	.7655	.532	.305
7	.710	.7654	.532	.305
8	.7103	.7655	.532	.3051
9	.710	.766	.532	.3051
10	.710	.765	.532	.3051
11	.7103	.7654	.533	.3052
12	.710	.7658	.533	.305
13	.710	.7657	.532	.3051
14	.710	.7656	.533	.3051
15	.7104	.7658	.533	.3051

The camera gear set pictured was a case in point where further corrective measures were required to true up a pd where off-center core pins caused slight variations. It should be noted, however, these gears were injection molded within approximately 0.003 limits on the pd. A second shaving operation was established to hold these limits within $\pm$ 0.001.

Nylon gears have been shaved, not only cleaning up the sides of the teeth, but actually increasing the depth of cut by cleaning up the root. In one case, after 200 pieces, tool wear was negligible on the grooves, but a little wear was indicated on the corners of the cutter that cleaned up the root. A Red Line check of these gears showed excellent results.

ACKNOWLEDGEMENT ...

. . . is made to the following companies for examples and information on their products:

Addressograph-Multigraph, Cleveland, Ohio
Atlantic Plastics, Stamford, Conn.
Chicago Molded Products, Chicago, Ill.
Dow Chemical Co., Midland, Mich.
du Pont, Polychemicals Division, Wilmington, Del.
Eastman Kodak Co., Rochester, N. Y.
Ford Motor Co., Dearborn, Mich.
General Electric Co., A & M Div., Bridgeport, Conn.
Haynes-Stellite Co., Kokomo, Ind.
National Cash Register Co., Dayton, Ohio
Packard Motor Co., Detroit, Mich.
Revere Camera Co., Chicago, Ill.
Shakespeare Co., Kalamazoo, Mich.
Tennessee-Eastman Co., Kingsport, Tenn.

ROUND TABLE

Two Masters

"I understand that Smedley is laid up, Ed. I hope it isn't serious."

"It's more serious than you think," replied Ed. "But he has no one to blame but himself—doing double duty as he has been for months."

"Double duty?" came back Al. "What do you mean—overtime? I haven't seen him around nights. In fact, it seemed to me he was beating the clock part of the time."

"I got the story from one of the boys—the fellow let the cat out of the bag accidentally, Al. After Smedley got through his supper, he slipped over to a small outfit working on sub-contracts and put in hours and hours—sometimes he wouldn't get home till one o'clock in the morning."

"Maybe the guy is hard-pressed for cash and is trying to get ahead of inflation, Ed."

"Could be. But it seems to me that his responsibility as an employee is being pushed around—looks to me like Smedley is trying to serve two masters."

"What're you going to do about it, Ed? What's it to you what the man does in his off-hours—aren't you infringing on the man's initiative?"

"How about the man infringing on the employer-of-the-first-part's interests? I sort of feel that Smedley is obliged first to his regular job—at least, he should have consulted me about going over to the other job in offhours."

"Any objections to him having an extra egg for breakfast?" smiled Al. "I think you're griping over something that's unnecessary—better have a good night's rest, Ed, and you'll feel different in the morning. It's his business, you know."

"That's one of the points about Smedley that I worry about—the man isn't getting his proper rest, and as a consequence is now run down to such an extent that we're losing valuable man-hours."

***IS A MAN'S** after-hour time his own—if it affects his day's work? If it is not, how can a situation like this be corrected? Your ideas and opinions on this subject will interest others. Discussions of earlier problems appear on later pages.*

Die-cast aluminum supercharger impeller is placed in wet abrasive blasting cabinet as the first step in direct chrome plating. Door at left permits entry of large parts

Held in a special fixture, and still protected from contact with the air by a film of abrasive slurry, the impeller is placed in the plating bath

WET BLASTING PERMITS DIRECT CHROME

No intermediate plating or anodizing steps are necessary if plating follows wet blasting at once. Blasting multiplies gripping surface ten times

CHROME plating of aluminum has been performed for a considerable time, to add to the fundamental qualities of the lightweight base metal the important factors of hardness, low surface tension, corrosion resistance and wear resistance. Accepted plating procedures, however, have not been considered commercially practicable because of the time and expense involved. Frequently, the quality of the resultant plate is inferior and subject to flaking, spalling or cracking.

The primary difficulty in plating aluminum directly lies in the rapidity with which an oxide forms on the metal surface and prevents creation of a bond between the two materials. The commonest method to date has been to clean the work in a chemical cleaner, apply a zinc coat in an immersion zincate bath, then copper, nickel and chrome plate. This process involves a tremendous amount of work handling and a large investment in equipment, which places it beyond the reach of the small job shop, or even larger potential installations where the volume of work does not justify great expenditure. A second popular process involves anodizing the aluminum before plating. While this is slightly less costly, it still requires an extra intermediary step; clean, anodize, plate.

Of particular interest, therefore, is a new two-step process developed by the Cro-Plate Co., Inc., Hartford, Conn. In this procedure the work is cleaned by wet blasting, then immediately immersed in the plating bath. A film of water and abrasive remains on the work during transfer and prevents rapid oxidation of the surface. As the work is scrupulously clean, the film is continuous, but it is recommended that the wet-blasting unit be located in close proximity to the plating tank to avoid unnecessary delay. In the plating tank, the chemically inert abrasive washes off and falls harmlessly to the bottom of the tank, allowing the work to plate.

Wet blasting is an essential part of the process, as it serves not only to remove existing oxides and dirt, and to form a protective coating, but also minutely peens the surface. It is estimated that actual surface area is increased about ten times by blasting, and this aids materially in securing a good bond.

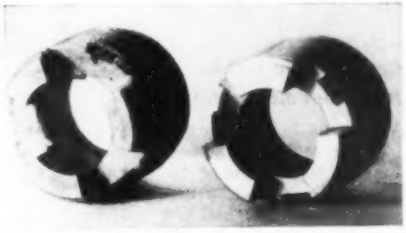
Cro-Hone equipment, made by the same company, may be used for wet blasting. Units are available in a range of sizes and types to suit the class of work

Self-contained, high-speed chrome-plating unit incorporates a 45-gal. tank, rectifiers, transformers, heaters and all controls in a 4×4-ft area

Battery of specially designed, semi-automatic wet-blasting machines for producing a clean, smooth inside surface on injection nozzles

PLATING ON ALUMINUM

BY H. E. LINSLEY, ASSOCIATE EDITOR



Removal of burrs by wet blasting is fast and economical. Small parts may be handled in rotating barrels in a standard unit

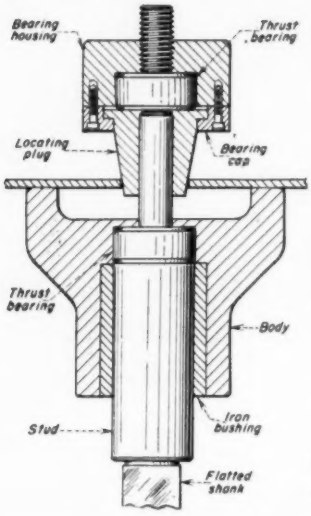
being handled. Smallest is a bench type with a worktable 14½×17½ in. Several standard units incorporate a 30×30-in. work area, and other cabinet models can be had for larger work. Easily adapted to automatic operation, they are self-contained, and have no moving parts. They can be moved to other parts of the shop for deburring, descaling, stock removal, or general surface-finishing jobs.

Standard plating equipment and solutions may be used. A high-speed solution, called Cro-Sol, made by the same company, permits deposition at approximately 0.008 in. per hr. Because successful production plating depends chiefly on extremely close control of all variables, the company has developed two self-contained plating units called Cro-Platers. One is a 500-amp unit, the other a smaller, bench-model, 100-amp unit. In these machines, all possible variables have been considered so both plating-bath temperature and the current density can be held to extremely close limits. With either of these units it is possible to deposit anywhere from a flash to several thousandths of plate, and hold size within ±0.00001 in.

The integration of wet blasting as part of the direct chrome plating of aluminum resulted after considerable searching for a simple, economical precleaning method that could be used for a variety of metals. The two-step blast and plate procedure has been applied successfully to wrought, sand-cast or die-cast material. Recent experiments have shown that it is equally applicable to steel and other metals, and both titanium and magnesium have been plated in the laboratory. These were experimental operations, but there are definite indications that they could be performed commercially without serious difficulty.

The coating deposited has a hardness of between 75 and 82 R_c, which makes the aluminum more wear resistant and gives it an impact value approximately equal to that of unplated mild steel. On sliding surfaces there is, of course, a substantial reduction of friction. Costs of chrome plating on aluminum by the direct process are equal to, or less than, the cost of conventional chrome plating on steel.

Practical Ideas



Carbide-Saw Holder Maintains Concentricity

WHEN YOU REGRIND carbide-tipped circular saws for high-speed operation, the saw must be ground concentrically or it will not work properly. The original saw holder we had located the blade by means of a tapered bushing, which was held in place by a stepped collar and locked with a wedge. Unfortunately, unless the operator maintained extreme care, the wedge slipped and let the saw get off center; or the wedge was too tight, and it made indexing most difficult.

The answer was to design a new holder which would bypass these troubles. The holder illustrated has hardened and ground bearing surfaces, except for the cast-iron bushing, which is lapped. The tapered locating bushing takes 1-, 1⅛-, and 1¼-in.-hole saws, and is also lapped to fit the stud.

Clamping pressure is applied between two thrust bearings, so the saw will rotate easily when pressure is applied; and it will not loosen up. *J. W. Newcomer, Kennett Square, Pa.*

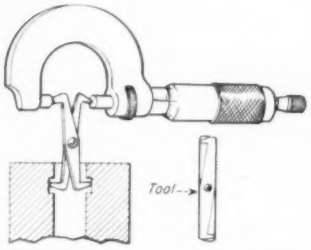
Scissor Adapting Tool Checks O-Ring Size

LACK OF PROPER measuring tool for an inside dimension prompted us to invent this little micrometer adapter. It spans the distance across a bored O-ring groove so we can check the depth of cut.

Made of two pieces of flat stock, the scissor-like affair is held together with a rivet—tight enough to hold the two shaped parts flat against each other, but loose enough to allow shifting them on one another.

The tool is folded together, inserted in the part, and expanded so the tips fit into the O-ring. Then the outside points are measured with a micrometer.

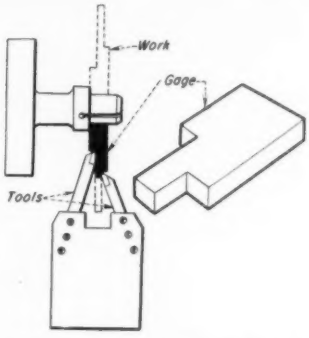
For absolute accuracy, in case the two scissor parts are not exactly of the same shape and dimensions, the tool can be brought out of the hole and the two outside points expanded again to touch the



anvil and spindle of the micrometer. Then a reading with another micrometer can be taken across the points that were formerly inside the O-ring. If the two parts of the tool are exactly made, and the rivet hole is exactly centered, this second measuring can be bypassed. However, it's a good check. *James E. Calhoun, Los Angeles, Calif.*

Expanding-Collet Gage Locates Tools

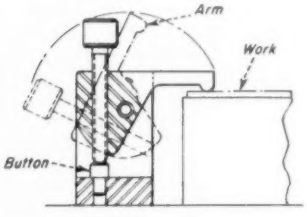
MUCH OF OUR WORK is first broached, then turned on lathes, which hold the work in expanding collets that



grip previously finished holes. For lathe setups, this style of gage is convenient for locating tools.

The gage is a simple block of steel, cut to the exact required workpiece outline. After the tools are roughly located in the toolblock, the gage is located against the shoulder of the collet when the collet is in its forward, expanded position (without, of course, a workpiece chucked). The gage is made to extend from the OD of the collet and from the shoulder so it will locate the tools exactly.

After the tools are clamped, the lathe is ready for work. This system saves much time and setup scrap. *Frank M. Butrick, Jr., Alma, Mich.*



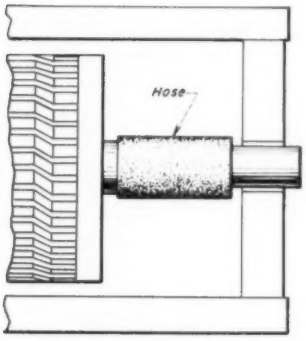
Quick Clamper Has Easy Action

IN SPITE of the many quick-acting-clamp designs there are nowdays, there is always room for one more; and this one is unusually quick.

The clamp arm is a loose fit on the pivot pin; therefore it only takes a few turns of the knurled-

head setscrew to release it completely so it will swing downward to clear the work.

A flick of the finger brings it back into position, and a couple of turns tightens it. *Inmon V. Hale, Piqua, O.*



Hose Saves Shafts

SUITABLE LENGTHS of rubber hose or double layers of sheet-rubber packing, can protect bearing surfaces of temporarily exposed shafts. Armatures and rotors from electric motors will be protected against accidental damage if covered this way when they are disassembled for servicing. *Thomas Trail, Cantonville, Md.*

Drillpress-Table Mark Helps in Realignment

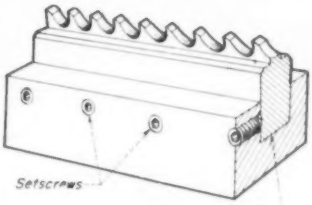
TO EASE realigning the drillpress table so its hole is directly under the spindle, a chisel-cut index mark can be cut in the table-support collar and the column. This should be at the most-often-used height. If the column is filed after the mark is made, the burr will be removed so the column will move up and down freely. *Thomas Trail, Cantonsville, Md.*

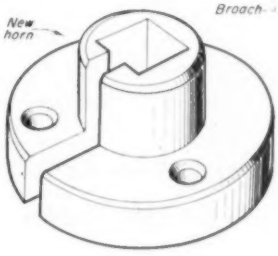
T-Slotted Horn Grips Broach Firmly

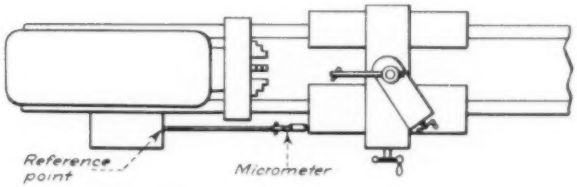
IN OUR CAST-IRON-GEAR department we have one operation that consists of broaching an internal keyway with a small vertical broach. With a conventional setup, the broach frequently worked out of the horn, producing keyways too deep. We made a new horn design and adapter which fitted into the horn and held the broach.

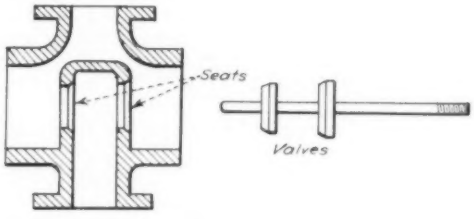
The horn has a deep T-slot instead of the conventional one. A channel adapter made with four tapped holes for sharp-pointed setscrews holds the broach firmly when it is inserted in this T-slot. The setscrews bear against shallow drill marks on the side of the broach, and prevent the broach from moving out. As the broach wears, we simply add shims.

The broach and adapter work in the horn as a single unit, with the front of the adapter bearing against the inside edge of the T-slot in the horn. *Frank M. Butrick Jr., Alma, Mich.*









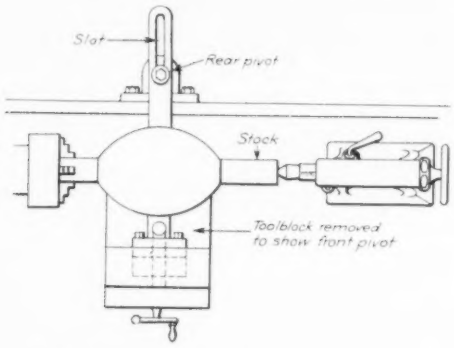
Dimension-Checking Matches Valves and Seats

WHEN YOU ARE MACHINING the seats of double-seated valves, it is pretty hard to get both seats to contact at the same time. A good method I have found for making sure the seats will work together involves chucking the valve in a lathe.

One seat is machined first, but before you move the carriage after the finishing cut, you select a fixed point on the lathe—in line with a convenient point on the carriage—and take an inside micrometer reading between the two points (or faces). The faces must be parallel.

Then you machine the other seat, taking about the same amount of metal off as on the first seat. After the second finishing cut, take another micrometer reading between the same points.

The difference between the readings is the distance between seats, and you can apply this dimension when machining the valves to make sure they are the same distance apart as the seats. *George A. Anderson, Baton Rouge, La.*



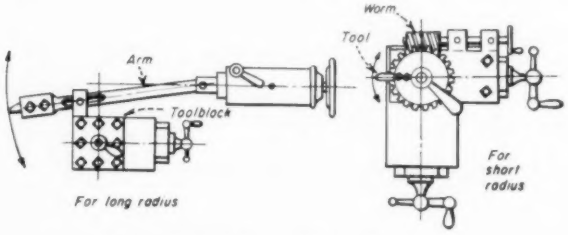
Adjustable-Arm Turner Cuts Large Radii

LARGE CURVES to be cut on turned surfaces (not on surfaces that must be faced) can be accurately formed with this kind of swinging-arm tool carrier. The arm is pivoted on a stationary bracket attached to the rear of the lathe—either on the bed or a housing.

The front end of the swinging arm is attached to a bracket at the edge of the cross-slide, and the cross-slide screw is disengaged. Both brackets allow the arm to pivot, but the rear one is slotted to allow adjusting the radial length of the arm.

A cut is taken by setting a toolbit in the toolpost, making the length from the center of the rear pivot to the tip of the tool the same as the desired radius, then feeding the carriage back and forth. Usually a number of roughing cuts must be taken, so this radial distance can be set roughly at first; but on the final cut should be measured off with a vernier caliper.

Free cross-slide movement is necessary to the operation of the device; especially if power traverse is utilized. *R. G. Vare, Christchurch, England.*

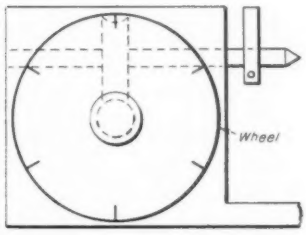


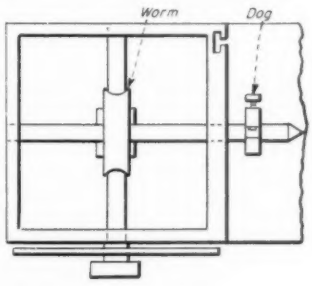
Two Radius-Turning Tools

WHEN A REQUIRED curvature is too large for an ordinary forming tool, one of these two attachments will fill the bill. Both are quite easy to make, and are accurate.

The large-radius tool (left, above) is unusually simple. The long bar has a jointed fitting that fits the tailstock. The bit is held in a small clamp, while the bar is moved by shifting the slide back and forth. A pin attached to the slide (or toolbox) goes through a long slot in the arm, thus allowing the tool to swing quite far in either direction. Arm length controls the radius.

The geared tool (right, above) is made by mounting a short stud instead of the regular toolpost, then pivoting a wheel on the stud. The toolbit is attached directly to the gear. Drive is accomplished by a worm meshing with the gear, mounted at the side of the slide. Lengthening or shortening the overhang of the tool changes the radius cut. *M. Yamaguchi, Kawasaki, Japan.*



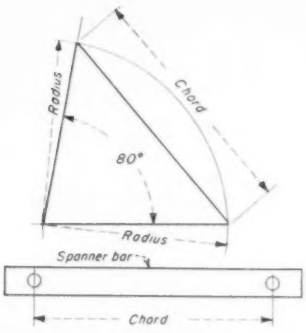


Small Dividing Head Built Easily, Cheaply

FOR THE SMALLER SHOP, or for a larger one that can use an extra dividing head, here is a design that is quickly built. The only precision parts are the spindle, and the gear set.

The worm and wheel can conveniently be picked for a 60-to-1 reduction ratio. These should be commercial gears, which will provide sufficient accuracy within the limits of the design. The dial plate, attached to the worm spindle, is divided into six major sections, with each hone representing a 1° rotation of the wheel spindle.

The frame of the device is made of steel plates, welded together, and drilled and bored after assembly. This is built so the dividing head can be utilized either horizontally or vertically. *R. H. Fry, Croydon, England.*



Getting Odd Divisions Of a Circle

ON SOME DIVIDING-HEAD jobs, where you encounter an out-of-round division, you have trouble unless you have an astronomical dividing head. We had such a job, calling for 26 divisions, some of which were not exactly at the 1/26th point, but were 2° ahead or behind it.

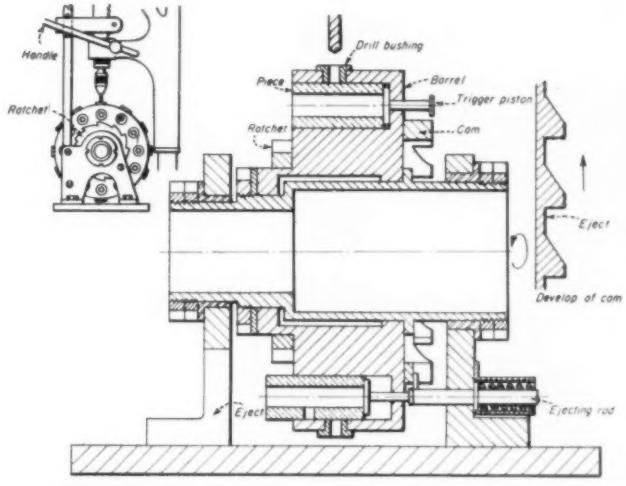
The 26 divisions were simple. Using a 39-hole index plate, we rotated the index arm one turn plus 21 holes for each division. But our standard 40-to-1 dividing head would not allow working out the 2° extra plus or minus movement. We solved the problem this way:

One full turn of the index arm equals a fortieth of 360°, or 9°. Therefore, a 2° additional movement (forward or backward) would be represented by 2/9 of a turn of the index arm. With the 39-hole plate in position, no hole could be picked up to give exactly this part of a turn.

However, 2/9 of 360° on the index plate (not the main spindle) would be 80°. We laid out a circle with exactly the same radius as that for the 39-hole circle on the plate, scribed a line through the center, then measuring exactly 80° from that line with a protractor. After scribing a line through the center and the 80° mark, we scribed the chord of the circle.

Now, we took a long piece of key stock, and drilled two holes through it on a jig borer. These were exactly the same distance apart as the length of the chord we had found. Pressing a pin through one of the holes (both holes were the same size as those on the index plate), we were ready to adjust the dividing head.

After setting off the regular 1/26th division on the head—one circle plus 21 holes—we replaced the pin of the index arm with the pin through the spanner bar. Then we moved the index arm (forward or backward, depending upon whether we were adding 2° or subtracting it) until we could slip the pin in it into the other hole in the spanner bar. This produced a division, on the work, of 1/26th of a circle, plus or minus 2°. The same idea can be adapted for similar dividing-head problems. *Clarence B. Winch, Tonawanda, N. Y.*



Dial Drilling Jig Locates Large-Lot Parts

WHEN QUANTITY ORDERS are sufficient in size, and when the parts are fairly simple, this sort of drilling jig can be built to maintain production at a high rate. It is a one-man setup, with the operator feeding the drill with his right hand, and inserting new parts with his left.

The fixture is built up on a baseplate, with a sort of barrel that rotates inside bearings in two end plates. Drill bushings are provided at each jig location. A new part is inserted in a nest, and is pushed back so the trigger piston behind each nest is extended fully out of the barrel. Each piston has a snap ring or cotter pin through its end to prevent it from falling out of the barrel.

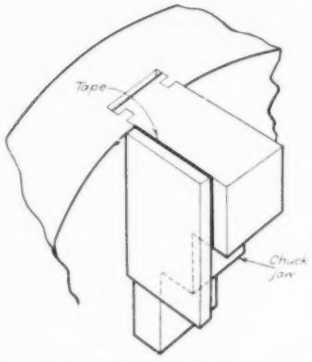
As the barrel rotates, each workpiece comes even with a spring-loaded ejector rod at the bottom of the fixture. The ejector rod has a cross pin at its end, which rides on the end of a cam attached to the barrel. When the trigger piston is just opposite the end of the ejector rod, the cam releases the ejector rod suddenly, knocking the work out of the nest into a pan.

The barrel-feed mechanism works off the drillpress feed lever. As the lever is depressed, it forces down a rod attached to a ratchet attached to the front end of the barrel, thus advancing the barrel one work position. To insure that the barrel will be in just the right position, so the drill point will not jam, the ratchet should catch and hold the barrel firmly. *M. Yamaguchi, Kawasaki, Japan.*

Three-Jaw Chuck Adapted for Step-Holding

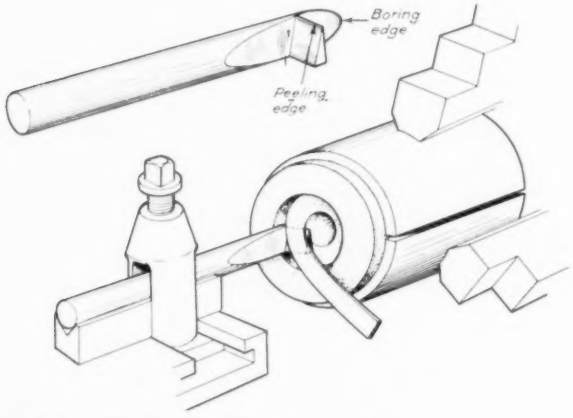
DOUBLED-SIDED Scotch tape enabled us to make a setup on a conventional three-jaw chuck that could normally be done only with a step chuck. We had a number of thin gear blanks to turn and face; so we held them with the chuck jaws against step plates that were simply stuck to the sides of the chuck jaws.

Three pieces of cold-rolled steel of the right shape and size were cut, then finished to fit against the chuck jaws, butted against the chuck body. The jaws extended just $\frac{1}{8}$ in. beyond the pieces. Double-sided Scotch tape was applied to hold the pieces to the jaws. Then the gear blanks could be chucked so they extended beyond



the jaws enough to allow the required cuts to be taken.

Anyone who has never used this double-sided adhesive tape will be surprised at how well it holds. *Karl Haller, Millington, N. J.*



Double-Cutting Boring Bar Slices Holes in Rubber

THIS IS A BORING TOOL that will really bore holes in rubber bushings, rollers, collars, and the like. Most mechanics are familiar with the method of parting off rubber washers with a knife blade or similar-shaped tool; and this idea follows that principle.

Enlarging a hole through rubber is difficult, usually, but I tried grinding down a piece of $\frac{5}{8}$-in. drill rod to the illustrated shape and got excellent results. The bar is formed to a keen knife edge on the front.

About $\frac{1}{4}$ in. back from the front edge is another cutting edge extending at right angles to the first, with its sharp edge up. This edge peels the rubber core from the hole after the first cut has been made. The result is that no rubber is left in the hole to crowd and impede the action of the primary cutting edge. *B. F. Johnson, Limcoe, Ontario.*

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for the best

PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards, and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N.Y.

130th Winners:
(For June 11)

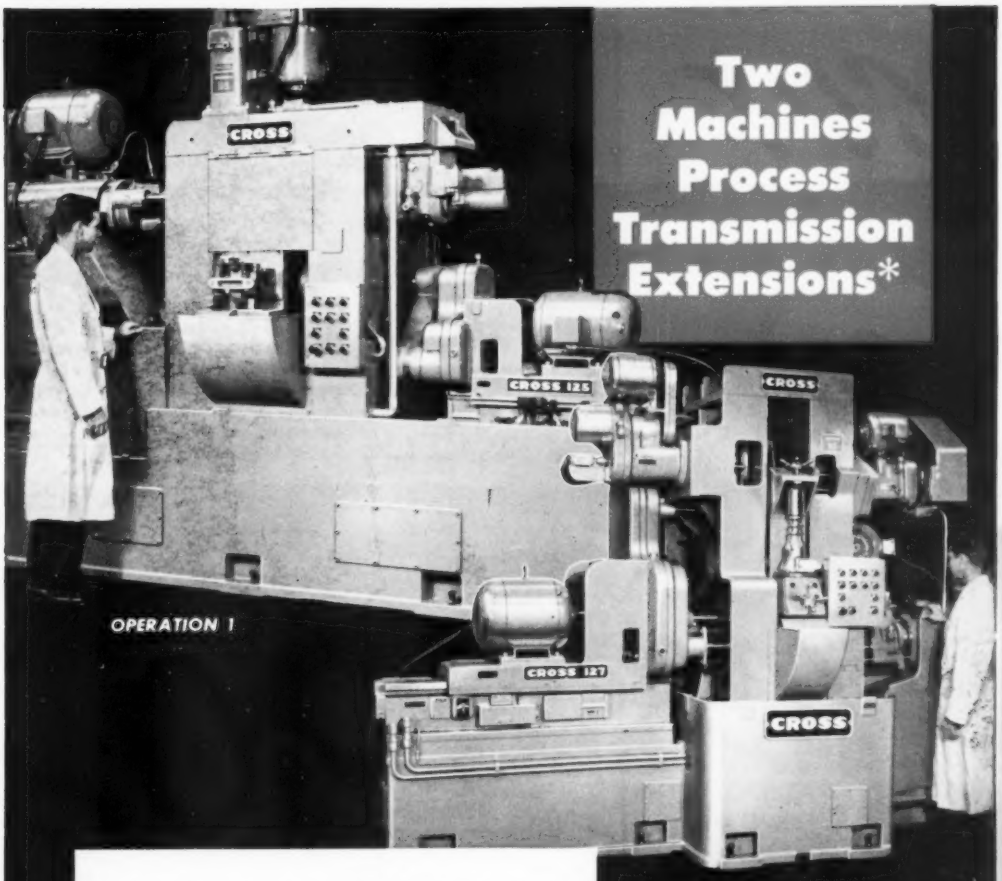
A Tie Between

Allan Clarke
Teeter-Board Follower

and

Mashahiro Yamaguchi
Screw-Slotting Attachment

Two Machines Process Transmission Extensions*



OPERATION 1

OPERATION 2

- ★ Operation 1: bore both ends; face large end; ream flange holes in large end; oil groove small end; chamfer and tap two holes in mounting flange.
- ★ Operation 2: mill mounting flange; drill, bore, chamfer and tap speedometer hole complete; drill, chamfer and tap two inspection cover holes.
- ★ 125 pieces per hour at 100%.
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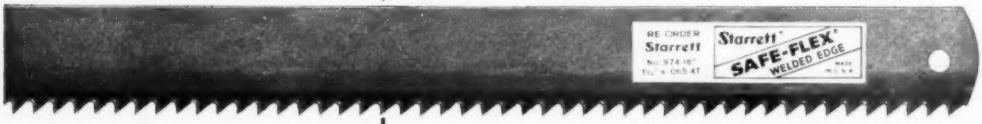
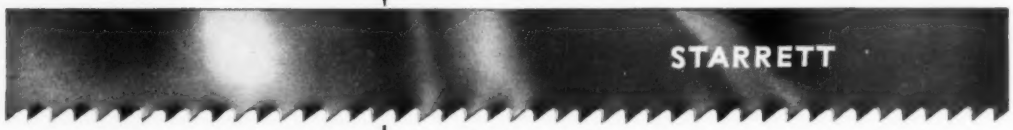


SAW

STARRETT *hard-edge, flexible back* metal cutting band saws for precision sawing, jig and contour cutting and friction sawing; *spring temper* band saws for cutting metal, wood and plastics; *Starrett "Skip-Tooth"* for cutting magnesium, aluminum, bronze, soft brass and other non-ferrous metals; also composition, fibre, bakelite, plastics and wood; and *Starrett* wood cutting band saws ... in coils in new handy reel dispenser or cut to length and welded.



SLICE

Starrett FAST-KUT Band Knives are unsurpassed for stack cutting, trimming, slicing or cut-apart operations involving soft or fibrous materials. Cut clean and fast without waste, chips, dust or ragged edges. Available in a complete range of sizes in straight-edge, scallop-edge or wavy-edge types — single or double bevel.

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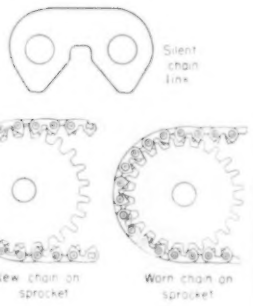
Silent-Chain Drives..I

The Silent Chain Division of the Association of Roller and Silent Chain Manufacturers developed "Engineering Standards for Industrial Silent Chains, Sprockets and Cutters." This report was approved by the ASME and the SAE and was accepted by the American Standards Association as American Standard ASA B29.2—1950. Material that follows relates to silent chain. Sprockets and cutters will be taken up in a forthcoming number.



Silent Chains

A silent or inverted-tooth chain consists of a series of links of the shape shown, and assembled over pins to form the desired width. As the chain pitch lengthens from wear, the links adjust themselves to a larger pitch circle. Such chains can be run in either direction, quietly and smoothly, at speeds up to 4500 fpm., if sprockets with suitable numbers of teeth are used.

Design of Chain Drives

In designing a silent-chain drive, matters to be taken into consideration are: nature of the load, horsepower to be transmitted, and speed of the driving and driven units.

Horsepower ratings can only be listed for a uniform rate of work, where there is relatively little shock or load variation throughout a single revolution of the driven sprocket. The tabulated values (page 131) are based upon life expectancy of approximately 20,000 hr under optimum drive conditions and a service factor of 1. Before establishing the design, the nominal or given horsepower should be multiplied by a service factor, Table 1, to provide the necessary extra capacity to cope with the expected severity of operation. Engineering judgement must be applied here in connection with the source of power, the nature of the load, and the resulting effects of inertia, strain and shock. Failure to do so may result in unsatisfactory service from abnormal joint wear, accelerated chain elongation and serious damage to the sprockets.

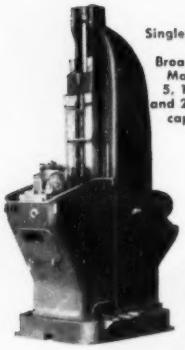
Operating characteristics of all types of equipment, considering their source of power, cannot be given for space reasons. The following relationships of types of machine driven and source of power are provided for a general guide (it being recognised that some sources of power will not ordinarily be used with the cited machines, but that the combination of characteristics of machine and power source may conceivably be extended to other situations).

Table 1..SERVICE FACTORS FOR SILENT CHAINS

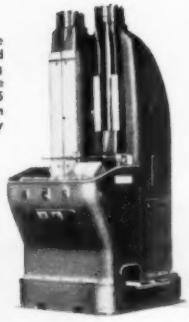
OPERATING CHARACTERISTICS	10 HR PER DAY	24 HR PER DAY (Extra long life)
A—Boring mill, lathe or drillpress with motor of equal rating	1.0	1.3
B—Drop hammer, grinder or miller with motor of equal rating	1.1	1.4
C—Punch press or shear with motor of equal rating	1.2	1.5
D—Drop hammer driven by oversize motor or drillpress by gas engine	1.3	1.6
E—Punch press driven by oversize motor or lathe by gasoline engine	1.4	1.7
F—Drop hammer or punch press driven by gasoline engine	1.5	1.8
G—Tumbling barrel driven by motor of equal rating	1.6	1.9
H—Tumbling barrel driven by oversize motor	1.7	2.0

Pitch of Chain

Select the pitch of chain according to Table 3. The higher shaft speed is the limiting factor and indicates the largest pitch chain that can be used. Also, this shaft diameter should be checked against the largest recommended bore in the sprocket selected. In general, the largest pitch gives the best drive, but limitations of sprocket diameters and the need for quiet operation often dictate smaller pitches. For the quietest drive, choose the smallest pitch that will carry the load. Large-pitch chains should be used for slow speeds and large power.



Single Slide and Broaching Machine 5, 10, 15 and 25 ton capacity



Duplex Surface Broaching Machine 5, 10, 15 and 25 ton capacity

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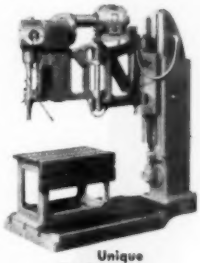
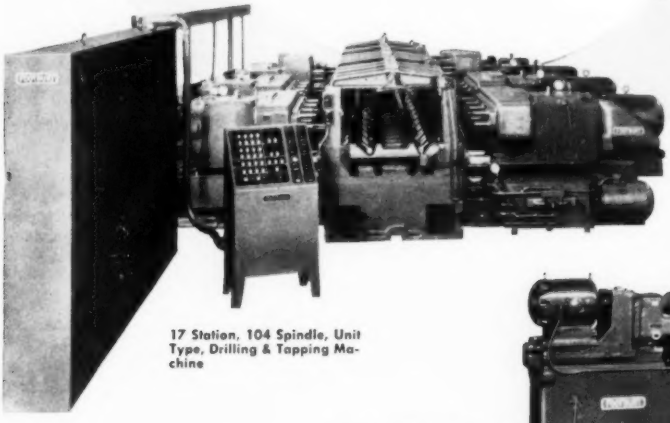
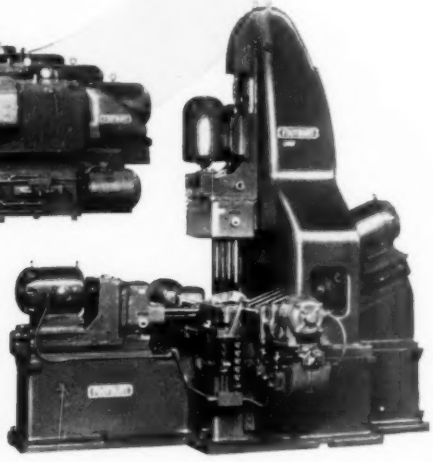


Unique Bracket Type Hammond Radial Drilling and Tapping Machine



17 Station, 104 Spindle, Unit Type, Drilling & Tapping Machine



Five Way 21 Spindle Lead Screw Tapping Machine

FOOTBURT *production machine tools*

. . . a time tested line of machine tools

Silent-Chain Drives..II

Table 2..HORSEPOWER CAPACITY OF SILENT CHAIN—PER INCH OF WIDTH

3/8-IN. PITCH

TEETH, SMALL SPRKT.	SMALL-SPROCKET RPM											
	100	500	1000	1200	1500	1800	2000	2500	3000	3500	4000	5000	6000
*17	0.37	1.7	3.7	3.9	4.2	5.2	5.5	6.3	6.8	7.0	7.0	–	–
*19	0.42	2.0	3.8	4.3	5.2	5.9	6.2	7.3	7.9	8.3	8.4	7.8	–
21	0.46	2.2	4.1	4.8	5.8	6.6	7.2	8.3	9.1	9.6	9.9	9.5	8.2
23	0.50	2.4	4.5	5.3	6.4	7.4	8.0	9.2	10.0	11.0	11.0	11.0	9.5
25	0.55	2.6	4.9	5.8	7.0	8.1	8.8	10.0	11.0	12.0	12.0	12.0	11.0
27	0.59	2.8	5.4	6.3	7.6	8.8	9.5	11.0	12.0	13.0	14.0	14.0	13.0
29	0.64	3.0	5.8	6.8	8.2	9.5	10.3	12.0	13.0	14.0	15.0	15.0	14.0
31	0.68	3.3	6.2	7.3	8.8	10.0	11.0	13.0	14.0	15.0	16.0	16.0	15.0
33	0.72	3.5	6.6	7.8	9.4	11.0	12.0	14.0	15.0	17.0	17.0	17.0	16.0
35	0.77	3.7	7.0	8.3	10.0	12.0	13.0	15.0	16.0	18.0	18.0	18.0	17.0
37	0.82	3.9	7.3	8.7	11.0	12.0	13.0	16.0	17.0	19.0	19.0	19.0	–
40	0.9	4.2	8.1	9.5	12.0	13.0	14.0	17.0	19.0	20.0	21.0	21.0	–
45	1.0	4.8	9.1	10.0	13.0	15.0	16.0	19.0	21.0	22.0	23.0	–	–
50	1.1	5.3	10.0	12.0	14.0	16.0	18.0	21.0	23.0	24.0	–	–	–

1/2-IN. PITCH

TEETH, SMALL SPRKT.	SMALL-SPROCKET RPM									
	100	500	700	1000	1200	1800	2000	2500	3000	3500	4000
*17	0.66	3	4	5	6	8	9	9	9	9	–
*19	0.74	3	4	6	7	9	10	11	11	11	–
21	0.81	4	5	7	8	11	11	12	13	13	–
23	0.89	4	6	8	9	12	13	14	15	15	14
25	0.97	4	6	8	10	13	14	16	17	17	16
27	1.0	5	7	9	10	14	15	17	19	19	18
29	1.1	5	7	10	11	15	17	19	20	20	20
31	1.2	6	8	10	12	17	18	20	22	22	22
33	1.3	6	8	11	13	18	19	22	23	24	23
35	1.4	6	9	12	14	19	20	23	25	25	24
37	1.5	7	9	13	15	20	21	24	26	26	–
40	1.6	7	10	14	16	22	23	26	28	28	–
45	2	8	11	15	18	24	24	29	31	–	–
50	2	9	12	17	20	27	29	32	–	–	–

5/8-IN. PITCH

TEETH, SMALL SPRKT.	SMALL-SPROCKET RPM									
	100	500	700	1000	1200	1800	2000	2500	3000	3500
*17	1.0	5	6	8	9	11	12	11	–	–
*19	1.1	5	7	10	11	13	14	14	–	–
21	1.3	6	8	10	12	15	16	16	16	–
23	1.4	6	9	12	13	17	18	19	18	–
25	1.5	7	9	13	15	19	20	21	21	19
27	1.6	8	10	14	16	21	22	23	23	21
29	1.7	8	11	15	17	22	24	25	25	23
31	1.9	9	12	16	18	24	25	27	27	25
33	2.0	9	13	17	20	26	27	29	29	27
35	2.1	10	13	18	21	27	29	31	31	28
37	2.2	10	14	19	22	29	31	34	33	–
40	2.4	11	15	21	24	31	33	35	–	–
45	2.7	13	17	23	27	35	37	–	–	–
50	3.0	14	19	26	30	38	40	–	–	–

3/4-IN. PITCH

TEETH, SMALL SPRKT.	SMALL-SPROCKET RPM								
	100	500	700	1000	1200	1500	1800	2000	2500
*17	1.5	6.5	8.6	11	12	13	14	14	–
*19	1.6	7.4	10.0	12	14	16	17	17	–
21	1.8	8.0	11.0	14	16	18	19	20	19
23	2.0	9.0	12.0	16	18	20	22	22	22
25	2.2	10.0	13.0	17	20	23	25	25	24
27	2.3	11.0	14.0	19	22	25	27	28	28
29	2.5	12.0	16.0	21	24	27	29	30	30
31	2.7	12.0	17.0	22	25	29	32	33	33
33	2.9	13.0	18.0	24	27	31	34	35	35
35	3.0	14.0	19.0	25	29	33	36	37	37
37	3.2	15.0	20.0	27	31	35	38	39	39
40	3.5	16.0	22.0	29	33	38	41	42	42
45	3.9	18.0	24.0	32	37	42	45	46	–
50	4.3	20.0	27.0	36	41	46	49	–	–

1-IN. PITCH

TEETH, SMALL SPRKT.	SMALL-SPROCKET RPM										
	100	200	300	400	500	700	1000	1200	1500	1800	2000
*17	3.0	5	7	9	11	14	17	18	–	–	–
*19	3.0	6	8	10	12	16	20	21	22	–	–
21	3.0	6	9	12	14	18	23	25	26	26	–
23	3.0	7	10	13	15	20	25	28	30	30	–
25	4.0	7	11	14	17	22	28	31	33	33	33
27	4.0	8	12	15	19	24	31	34	37	37	36
29	4.0	9	13	16	20	26	33	37	40	41	40
31	5.0	9	13	18	22	28	36	40	43	44	43
33	5.0	10	14	19	23	30	39	43	47	47	46
35	5.0	10	15	20	24	32	41	45	49	50	49
37	5.4	11	16	21	26	34	43	48	52	53	–
40	6.0	12	18	23	28	36	47	52	56	–	–
45	7.0	13	20	25	31	41	52	57	61	–	–
50	8.0	15	22	28	34	45	57	62	–	–	–

1 1/4-IN. PITCH

TEETH, SMALL SPRKT.	SMALL-SPROCKET RPM										
	100	200	300	400	500	600	700	800	1000	1200	1500
*17											
*19	4.5	8	12	16	19	21	23	25	27	28	–
21	5.0	9	14	18	21	24	26	29	32	33	–
23	5.5	10	15	19	23	27	29	32	36	37	37
25	6.0	11	16	21	25	29	32	35	40	42	42
27	6.4	12	18	23	28	32	35	39	43	46	46
29	6.9	13	19	25	30	34	38	42	47	50	51
31	7.4	14	21	27	32	37	41	45	51	54	55
33	7.9	15	22	28	34	39	44	48	55	58	59
35	8.4	16	23	30	36	42	47	51	58	62	62
37	9.0	17	24	32	38	44	50	54	61	65	–
40	9.6	19	27	35	42	48	54	59	66	70	–
45	10.7	21	30	39	47	54	60	65	73	–	–
50	12.0	23	34	43	52	59	66	72	80	–	–

1 1/2-IN. PITCH

TEETH, SMALL SPRKT.	SMALL-SPROCKET RPM										
	100	200	300	400	500	600	700	800	900	1000	1200
*19	6.4	12	17	22	25	28	31	32	33	34	–
21	7.0	13	19	24	29	32	35	37	39	39	–
23	8.0	15	21	27	32	36	39	42	44	45	44
25	8.0	16	23	30	35	40	44	47	49	52	51
27	9.0	18	25	32	38	43	48	51	54	56	56
29	10.0	19	27	35	41	47	52	56	59	60	61
31	11.0	20	29	37	44	51	56	60	63	65	66
33	11.0	22	31	40	47	54	60	64	68	70	71
35	12.0	23	33	42	50	57	63	68	72	74	75
37	13.0	24	35	47	53	61	67	72	77	79	–
40	14.0	26	38	53	58	66	72	78	84	–	–
45	15.0	30	43	54	65	74	81	86	90	–	–
50	17.0	33	47	60	71	81	89	94	–	–	–

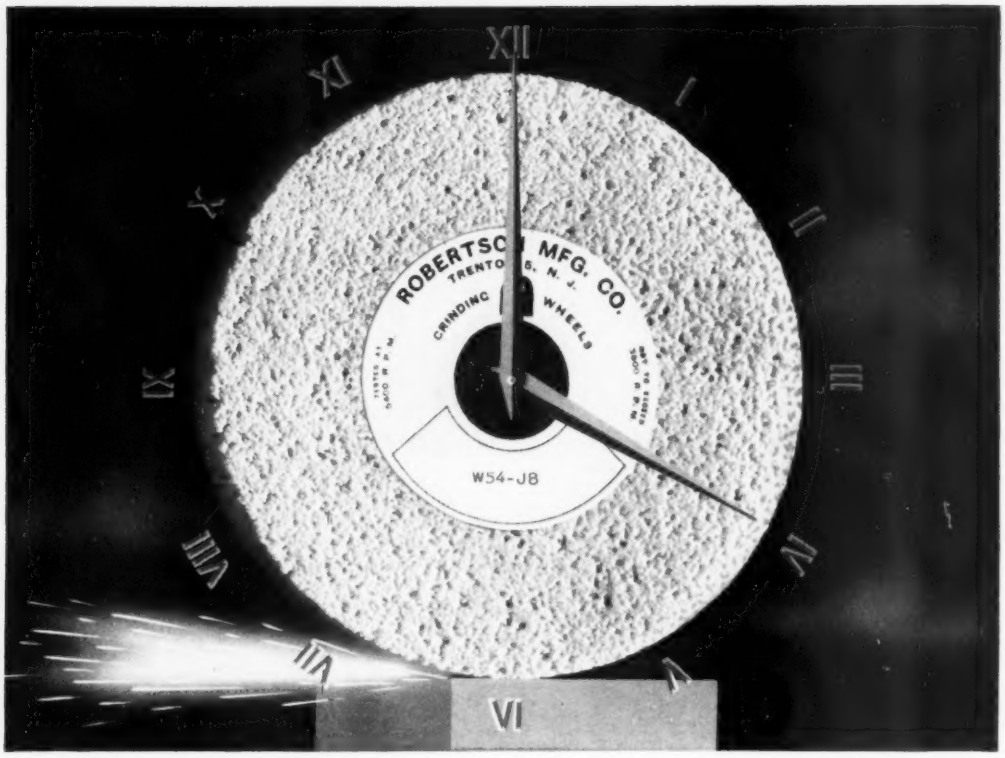
2-IN. PITCH

TEETH, SMALL SPRKT.	SMALL-SPROCKET RPM								
	100	200	300	400	500	600	700	800	900
*19	11.0	21	29	35	40	43	45	–	–
21	12.5	23	32	40	45	50	52	–	–
23	13.5	26	36	44	51	56	59	60	–
25	14.0	28	39	49	56	62	66	68	68
27	16.0	30	43	53	62	68	73	75	75
29	17.0	33	46	58	67	74	79	82	82
31	18.0	35	50	62	72	80	85	88	88
33	20.0	37	53	66	77	85	91	94	94
35	21.0	40	57	70	82	91	97	100	100
37	22.0	42	60	74	88	99	102	105	–
40	24.0	46	65	81	94	103	110	113	–
45	27.0	51	72	90	105	115	121	–	–
50	30.0	57	80	100	115	125	–	–	–

NOTES:

* For best results, smaller sprocket should have at least 21 teeth.

Lubrication: group to left of first zig-zag line, use bath or splash, oil cup or brush; central group, use disk or circulating pump; right-hand group, consult manufacturer.



HERE'S WHAT WE MEAN WHEN WE SAY . . .

"now you can buy Production-Time"

There are only 24 hours in a day and nothing you can do will add to the total. But the *production* you can get out of those 24 hours can be greatly increased. You can *buy* production-time by buying the right grinding wheel for the job.

Robertson's new, Cool-Cut wheel is no cure-all for every grinding problem, but, properly applied, it can step up your production-time to a remarkable degree. Here, for example, is what a Robertson Cool-Cut did for one customer:

Using an 18" x 5" x 15" conventional wheel, on a Hanchett Vertical Surface Grinder, for .040" to .060" stock removal from 1020 steel, $\frac{5}{8}$" thick, the customer was turning out only 26 pieces in 2 hours and 40 minutes, with an ampere reading of 60. Wheel feed was two ten-thousandths per chuck revolution.

When, on the recommendation of a Robertson Sales Engineer, a WA243-H-2V Robertson Cool-Cut wheel was tested on the same job, production jumped from 26 pieces to 170 pieces in the same time, with an ampere reading of between 37 and 40. Wheel feed was increased to eight ten-thousandths per chuck revolution.

In other words, the Robertson Cool-Cut wheel increased production on this particular job *more than 6 times* and with a substantial saving in power-cost too!

Would you like to buy that kind of production-time for your shop?

This pocket-size booklet, "How to Buy Production-Time," tells the full story of Robertson Cool-Cut wheels. Write, on your business letterhead, for a free copy.

ROBERTSON MANUFACTURING CO.
TRENTON 5, NEW JERSEY

RESIN-BONDED AND VITRIFIED-BONDED GRINDING WHEELS • MOUNTED WHEELS • SEGMENTS

Silent-Chain Drives..III

Chain Width

Determine chain width on the basis of horsepower per inch of chain width, as given in Table 2. Thus chain width equals the nominal horsepower times the service factor divided by the horsepower capacity per inch of chain width. It is possible to make two or more sound selections, but strive for a pitch and sprocket size that will allow a chain width less than eight times the pitch.

Chain Length

The length of chain is:

$$L = 2C + \frac{(N+n)}{2} + \frac{\left(\frac{N-n}{2\pi}\right)^2}{C}$$

where L = chain length in pitches; C = center distance in pitches; N = number of teeth in large sprocket; n = number of teeth in small sprocket, and $2\pi = 6.2832$.

Center Distance

Minimum center distance between sprockets is the sum of the sprocket diameters under normal conditions. Long centers are practical on drives where provision is made for adjustment for chain wear or stretch.

Speed Ratio

The speed ratio is the basis of selection for driving and driven sprockets. The smaller sprocket is usually selected first on the following basis:

Speed Ratio	1:1	2:1	3:1	4:1	5:1
Small Sprocket teeth	25-35	19-29	19-25	19-23	19-21

Ratios as high as 8:1 are possible, but the use of sprockets with less than 17 or more than 120 teeth is to be avoided in the interest of long life and efficient operation. Table 4 gives desirable sprocket combinations for various ratios.

Chain Speed

Chain speed in feet per minute is given by

S = No. of teeth $\times$ rpm $\times$ pitch (in.) $\div$ 12.

Lubrication

Wherever possible silent chains should be operated in an oiltight casing with provision for lubrication. When the chain speed is less than 1500 fpm, a drip or sight-feed oiler can be used. The oil should be applied to the inner surface of the chain at the rate of about one drop per minute.

When the chain speed is from 1500 to 3000 fpm, bath lubrication is recommended. Oil level in the casing is maintained so that the chain is immersed, while running, to a depth of approximately ½ pitch.

Viscosity of the oil used depends upon chain speed and temperature conditions. Straight mineral oil of SAE 30 viscosity is generally employed, but SAE 50 or 60 can be used on very slow moving chains. Avoid greases as they cannot penetrate the "joints" of the chain at ordinary temperatures.

Offset Links

Avoid use of offset links or chain lengths of an uneven number of pitches.

Table 3 . . Silent-Chain Speeds for Various Pitches

PITCH IN.	PITCHES PER FT.	CHAIN WIDTH, IN.	WEIGHT PER FT 1" WIDE	SMALL SPROCKET NORMAL RPM	SMALL SPROCKET MAX. RPM†	DRIVER MIN. TEETH*
⅜	32	⅜- 4	0.75	4000	6000	19
½	24	½- 7	1.00	2600	4000	19
⅝	19.2	⅝- 8	1.25	2300	3500	19
¾	16	¾-10	1.50	1650	2500	21
1	12	1-14	2.00	1300	2000	21
1¼	9.6	1¼-20	2.50	1000	1500	23
1½	8	1½-24	3.00	800	1200	23
2	6	2-30	4.00	600	900	25

* *Smaller numbers of teeth on the driver may be used under certain conditions. For these drives consult manufacturer.*

† *Under favorable conditions these values may be exceeded, and under unfavorable conditions they must be decreased.*

Table 4 . . Sprocket Combinations for Various Ratios

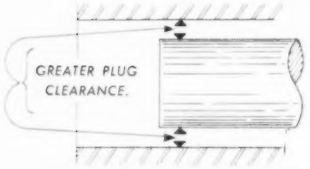
RATIO	PINION	SPRKT	RATIO	PINION	SPRKT
1.00	25	25	2.71	21	57
1.09	23	25	3.00	19	57
1.10	21	23	3.04	25	76
1.11	19	21	3.3	23	76
1.19	21	25	3.62	21	76
1.21	19	23	3.80	25	95
1.32	19	25	4.00	19	76
1.52	25	38	4.13	23	95
1.65	23	38	4.52	21	95
1.81	21	38	4.56	25	114
2.00	19	38	4.95	23	114
2.28	25	57	5.00	19	95
2.48	23	57	5.43	21	114

LET'S GET IT STRAIGHT!

The "DIMENSIONAIR" Air Gage —

EACH GRADUATION IS .00005"
AND NO DOUBT ABOUT IT.

LONGER PLUG WEAR
because of greater JET clearance.



GREATER PLUG
CLEARANCE.

IS calibrated accurately over its entire range

IS set accurately with only one master

HAS a range of .003" with 2500 to 1 magnification

HAS much longer plug wear

HAS greater plug clearance so that the same plug can be used on both rough and finished dimension

REMAINS stable for long periods of time

YES, LET'S GET IT STRAIGHT, the Dimensionair uses its own operating principle and new mechanical devices which do away with the limitations common to previous types of air gages.

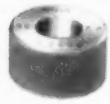
ACTUAL SIZE: 9" x 7⅜" x 8½"
WEIGHT 17¾ LBS.

FEDERAL
DIMENSIONAIR
PROVES ITSELF

Why not find out to your own satisfaction what the Federal Dimensionair will do for you! Put it to work—discover how the exceptional measuring range of .003" lets you gage irregular shaped and tapered holes. Oil or coolants won't affect the Dimensionair: grit and dirt won't clog it: rough handling won't harm it.

Find out how the Dimensionair can do all this and more—ask our nearest representative to show you the Federal way to better, more positive air gaging, or write to us for complete information and prices.

FEDERAL PRODUCTS CORPORATION, 1128 Eddy Street, Providence 1, Rhode Island.



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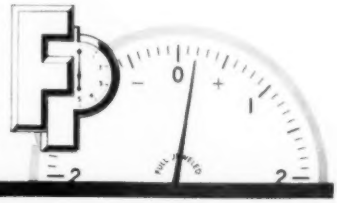
Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL INDICATING GAGES



TALKING SHOP

Accident Frequency

A RECENT SURVEY indicates several important facts about accidents. First, greatest number of accidents occur at 10:30 AM, and 2:30 PM—the peaks of the fatigue curve. Second more accidents occur on Monday than any other day of the week—probably a result of weekend relaxation. Third, more accidents occur in August than any other month—possibly vacation "hangover."

Labor Makes Its Mark

A SMALL GERMAN COMPANY was recently faced with the need for a grinder. Inquiry showed that a grinder in which the wheel was reciprocated by hand could be bought for 4000 marks (1 mark equals 25¢), while one with complete hydraulic and mechanical feed cost 16,000. The decision was made to buy the hand-fed unit because a workman to handle it could be employed for about 1000 marks a year, and the machine should be depreciated in about three years. Incidentally, rates for skilled operators have risen recently from 1.2 marks to 1.75 marks per hour.

Rolled Stainless

THREADS can be rolled on stainless bars without the galling problem sometimes encountered when they are cut. According to E. Von Hambach of Carpenter Steel Co., rolling increases hardness somewhat, for example from R_B92-25 to R_c33-35, and this added hardness reduces the tendency of the thread to stick and gall in service. Threads have been rolled on Type 302 (suitable up to 800F), and on 347 and 321 (up to 1400F) for high-temperature service, or on jets.

Drill Bill

ONE OF THE JOBS that New York Air Brake has run on a multiple-spindle bar machine is a small steel screw with a 0.015-in.-dia hole located 0.020 in. off center. When drill breakage was excessive, tool engineers decided a higher drill speed was required and set up a 75,000-rpm air-driven spindle for the job. But breakage continued high. The real answer was found in building a precision drill spindle that ran absolutely true and in reducing speed to approximately 15,000 rpm. When this was done, the tiny drills stood up well, requiring only normal tool maintenance.

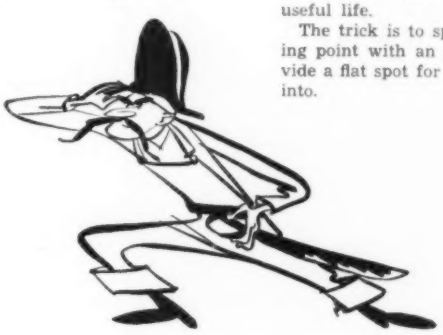
Shorty

TO INCREASE drill life and reduce chance of breakage, use as short a drill as possible for the job. It's stronger. In other words, short drills (with web thinned) for shallow holes, long drills for deep ones.

Skill Pirating

MORE AND MORE COMPANIES are finding labor shortages in three areas: foremen, tool engineers, and setup men—in other words, the skilled men. The general admission is that few companies are doing any training themselves, have simply pirated skilled men when and where needed. But now the supply is drying up, because some sources see little return in training men to be stolen by others, others have taken steps to retain men they've trained.

Indications are that training programs, particularly for tool engineers are an overdue need.



Tool Inspector

ONE ARGUMENT against machine rather than free-hand grinding is that it increases toolcrib work. E. Von Hambach, stainless-steel specialist for Carpenter Steel Co., is authority for the statement that it actually *reduces* toolcrib labor. In one plant, tools on stainless were lasting from 40 min to an hour. A little examination showed that toolcrib men were grinding freehand, and a 7° clearance angle, for example, varied from 2° to 15°, even varied along a tool. Tools got one rough pass and a sparkout, but even then, tools awaiting regrinding were all over the place. Installation of real grinders, and advancement of one competent man to tool inspector added to the overhead, but solved the problem. Now tools are ground to specified angles—or they don't leave the crib. Furthermore, they get mirror finish, roughing with a 60-grit, finishing with 120-grit, and polishing with 320-grit. But they last a full shift between grinds, even on automatics, and the tool-grinding crew has erased the backlog.

Spotface Before Drilling

A HOLE to be drilled off-diameter through the side wall of a cylinder raises hob with drills and bushings—unless it is done right. Bushings close to the work are not the answer; chips catch there and jam the drill or push out the bushing. If the bushing is away from the work, the drill either runs off line, or slides off the surface, then breaks. The continual pressure on one side of the bushing will wear it there and wear the lands off the drill, shortening its useful life.

The trick is to spotface the starting point with an end mill to provide a flat spot for the drill to start into.

News of Metalworking

• **PATENTS RELEASED**—Among 11 patents dedicated for free use to the public by Solar Aircraft Co., San Diego, are: a bubble cap assembly for fractionating towers that may be economically formed from corrosion-resistant thin sheet metal; a centrifugal casting machine for forming exhaust parts for airplane engines; an aircraft combustion heater with controls that eliminate the need for superchargers.

• **MORE TITANIUM** — Titanium production at P. R. Mallory is being increased to 450,000 lb in 1952 and to 1.5-million lb in 1953.

• **CAPACITOR SHORTAGE** — Electrolytic capacitors which use tantalum as a basic material may soon be in short supply. Munitions Board is encouraging study of circuits using these components for actual need and possible substitutions of capacitors containing material less critical than tantalum.

• **TO MAKE OPTICAL GLASS**—Optical glass produced by the famous German Schott method may be provided by facilities within continental U.S. Discussions have been under way between Corning Glass Works, Perkin-Elmer and other interested parties.

• **FLEXIBLE TAILPIPE**—A flexible exhaust tailpipe for jet fighter engines, developed by Wright-Patterson AF Base power plant laboratory, features a simple bellows fabricated from high-temperature, corrosion-resistant steel. Planes in high-G dives meet with forces resulting in after-fuselage deflection of as much as three inches, which may buckle tailcones.

Here's How You Price Machinery Under New Controls Regulation

WASHINGTON — Wondering how to price under the new controls law? Official statements out of Washington don't help much. But despite all the confusion, it's possible to see just what machinery manufacturers are required to do.

For the time being, they must price under one of three regulations: the General Ceiling Price Regulation (the freeze of last January) or Ceiling Price Regulation No. 30 or GOR-15. The deadline date for filing price data with the Office of Price Stabilization under CPR-30 has been revoked entirely.

• **Now all a business** that hasn't begun to price under CPR-30 need do is figure out which of the three regulations will give it the best deal. If GCPR does, it need do nothing but continue to use the Dec. 19-Jan. 25 price. If CPR-30 does, then an OPS Form 8 must be filed; and if there's no objection from the agency within 15 days, the increases prescribed by the regulation can be put into effect. Once a business leaves GCPR, and has started rollbacks under 30, it cannot go back.

But this is only temporary. The Capehart amendment to the extended controls act provides for relief to businesses "upon application and a proper showing . . . of prices and costs." Granting of this relief is mandatory. OPS must then adjust ceilings to reflect cost changes, including overhead, up to July 26—instead of March 15, as provided by CPR-30.

OPS is talking of setting up procedures to handle these applications. But it is only just talk. Price boss Michael V. DiSalle is going to raise prices for all manufacturers, blanketwise—even though the law requires only that he act on individual appeals, case by case.

DiSalle is in this pickle: Should he permit industry to allocate overhead costs among items in a line as it wishes—and maybe load them all on single profitable item? Or should OPS audit each application for an increase?

The paperwork auditing would take is stupendous. OPS says it would need 15,000 new auditors, cost-accountants, etc., to do the job. Such a work load would bog OPS down to where it couldn't function at all.

• **So a new set** of manufacturers' regulations are coming—to replace CPR 22, CPR 30 and the other tailored orders. Base periods, cut-off dates, and allowable costs will be changed to conform with Sen. Capehart's amendment.

Strike Closes Brown & Sharpe

PROVIDENCE, R. I. — Brown & Sharpe Mfg. Co. has closed down all operations at its main plant here and at its Greystone Div. plant, following a strike called Aug. 1 by International Assn of Machinists, AFL, which represents approximately 4500 of the employees. Some 8000 company employees are affected by the shut down.

METALS COATED with ceramics by the Solaramic Process developed by Solar Aircraft Co. withstand extremely high temperatures without oxidizing or corroding. The two samples of AISI 321 stainless steel shown here were tested at 1850 F. The ceramic-coated piece at the left is shown after 150 hr of testing, compared with the uncoated sample at the right after only 20 hr of testing. Ceramic-coated stainless steel in certain jet engine components is now being substituted for an expensive alloy, with 90% cut in nickel consumption

Pirating Plagues Tool, Die Industry

BUFFALO, N. Y.—Defense business in the tool and die industry is on the upswing, but labor pirating continues to be a major problem, it was reported by trustees of the National Tool & Die Manufacturers' Assn meeting here August 6.

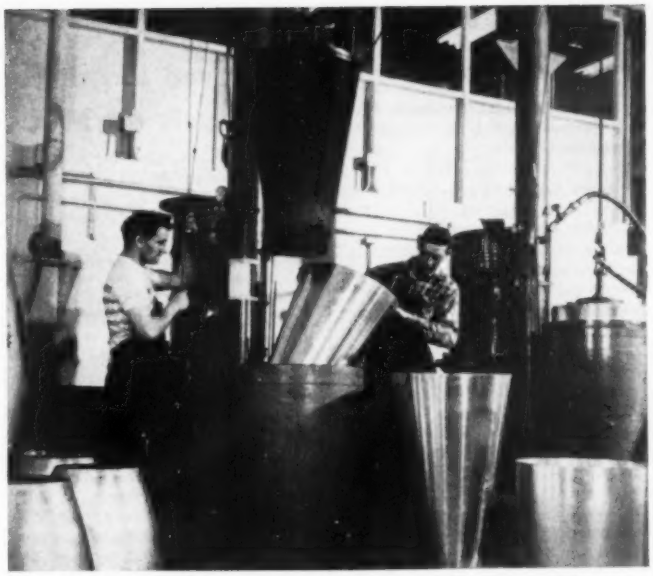
Herbert F. Jahn, NTDMA president, and president of B. Jahn Mfg. Co., New Britain, Conn., disclosed in a report on business and labor conditions that most areas, except Cincinnati and eastern Massachusetts, have orders for tooling and development on armament that approximate 50% to 75% of their new business. In western Massachusetts, armament tooling orders represent 95% of new business, mostly from large prime contractors.

• **On the labor situation,** it was reported that (1) A number of tooling areas have the equipment to increase staff and output but cannot do so because of the tight skilled-labor market; (2) A number of areas are unable to train new workers because of draft deferment policies. Many local draft boards do not recognize the industrial importance of the toolmaker and the necessity for long-term apprenticeship required to make a good toolmaker.

The Buffalo meeting was followed during the week by meetings in New York and Chicago with special committees set up by the Wage Stabilization Board. The WSB committees were informed that immediate action was needed to stabilize the skilled labor situation in the tool and die industry.

Frank Wickstrom, president of New York Tool & Die Institute, submitted a statement in which the industry suggested action along the following lines:

• **Set up definite top rates** for each classification in each area.
• **Determine the rates** by a survey in each tooling area.
• **Control hiring** through use of certificates of availability so that new plants cannot step in and offer higher rates than those prevailing.
• **Establish a regional board** for enforcement purposes, to be made up of two labor representatives, one public member, one contract shop representative, and one captive shop member.



NEW DEMAREST METAL FORMING process cuts cost and time in fabrication of aluminum jettisonable fuel tanks for the Air Force, according to Vic Pastushin Industries, Inc., Los Angeles. A blank—a rolled and Heliarc seam-welded cone—is fitted inside Meehanite die as first step in forming. Rubber die descends; then, with steel lid locked (right), rubber die is expanded by 400 psi fluid pressure to form fuel-tank section. Tank sections are formed in a single operation in less than three minutes each compared to the 15-20 minutes required if formed by spinning. Process was named for Charles Demarest, Pastushin's chief tooling engineer

U. S. Tanks Prove Mettle in Korea

BY ALPHEUS JESSUP
McGraw-Hill World News

TOKYO—American tanks have held up well in Korea. They have won every tank-to-tank battle. But the Korean terrain and Korean-type warfare have shown up some gaps in the capabilities of US armor.

• **Tanks have sufficient firepower.** Most of the time, in fact, available firepower exceeds the opportunity for using it. But enlisted tank commanders think medium tanks should carry two .50-cal. machine guns with full circle traverse to deal with infiltrating personnel.

• **High maneuverability** of tanks in Korea has been proven. Tank commanders have taken the M-4 Sherman up hills meant only for mountain goats. But the newer M-26 and M-46 have had a tough time on the hills and mountains. The M-46 drivers rate the M-46 super for getting out of tight spots—on the level.

• **Medium tanks show up best.** "The relatively flat lands of western Korea favored the medium tank with the wide tread span, while the central and easern sectors of Korea favored the medium tank with the narrow tread span because of the narrow roads and defiles," according to the Ordnance Officer, General Hq., Far East Command.

Some M-46 drivers, however, would like to use the wide treads even in the hills. They think this would save suspension systems and improve flotation and pull on the dirt-rock roads.

• **Tanks are not too complicated** for American crews. Driving skill and firing accuracy are a matter of practice and teamwork. Maintenance is and isn't complex. The M-4 and M-26 both use Ford motors, well known to maintenance men, so work on these has been simple. But the M-46 has the newer Continental 750 hp, air-cooled engine, and breakdowns, while few, do mean longer repair periods, until more mechanics become familiar with the Continental.

Industrial Notes

• **Universal Metal Products, Inc.,** has moved into a new plant in Wickliffe, Ohio.

• **Doerr Electric Corp.** is the new name of Electro Machines, Inc., Cedarburg, Wis., changed to prevent confusion with several similar firm names.

• **Heli-Coil Corp.** has moved from Long Island City, N. Y., to a new plant at Danbury, Conn. The company also announced departure of Eugene M. Lang, manufacturing vice president, to Japan to set up production of Heli-Coil thread inserts and tools in the plant of Tsugami Mfg. Co., Ltd., Tokyo.

• **Simonds Saw & Steel Co. and Simonds Abrasive Co.** have moved their combined office, shop and warehouse to 3323 West Addison St., Chicago. The move gives 40,000 sq ft of floor space all on one level.

• **Admiral Die Casting Corp.** has completed a new plant at 200 West 83rd St., Chicago, fully equipped with new, latest type high-pressure die-casting machines for aluminum, zinc, and magnesium die castings.

Air Force Expansion Set, With Emphasis on Medium Bombers

WASHINGTON—The decision to expand US air power has already been made. Details will be announced in October. Final group strength for the Air Force is unknown, but Representative Carl Vinson, chairman of the House Armed Services Committee, has called for 138 combat groups, plus 25 troop-carrier groups, a total of 163.

There will be a shift in emphasis from the intercontinental bomber, like the B-36, to the medium bomber.

• **This means more business** for the aircraft industry. This year's appropriation request carries $15 billion for aircraft and related procurement. Next year it will go even higher. Right now we are building for a capacity of 50,000 planes a year. Actual production will be about half that much. We should be hitting the 25,000 mark by June of next year.

• **It's feast for some** plane makers, slim-times for others, depending on performance shown by the many new aircraft — fighters, bombers, transports — now on the drawing boards and in the air being flight tested.

Here are the planes in the immediate air future:

• **Superbombers:**

Convair's B-36, and its all-jet swept-wing version, the B-60, not yet built. Ultimately we'll have about 230 B-36's.

Boeing's B-52 with eight turbojets, not yet built.

• **Medium bombers:**

Boeing's now obsolescent B-29, and its six-jet swept-wing version, the B-47 Stratojet.

North American's AJ-1 (Navy), a twin piston-engine plane with a third Allison turbojet mounted in the fuselage.

Lockheed's P2V Neptune (Navy), with a normal range of 4200 miles.

Consolidated P5Y, and the Martin P4M, both Navy long-range seaplanes.

• **Light bombers:**

Canberra, a British jet bomber to be built here by Martin. Now a twin-jet, it will be converted to four jets.

Martin XB-51, a three-jet tactical bomber of radical design.

North American B-45 Tornado, a four-jet craft carrying a four-man crew, said to be in the 550 mph class.

• **Fighters:**

Northrop F-89 Scorpion, an all-weather fighter topping 600 mph.

Lockheed F-94, also an all-weather fighter in the Scorpion class.

North American F-86 Sabrejet, currently the top Air Force fighter.

Consolidated's XF-92, an experimental model, is being flight tested.

Top Navy fighters are: McDonnell F2H Banshee; Douglas F3D Skyknight; Chance Vought F7U Corsair; and Grumman F9F Panther. All are carrier-based jets with speeds in the 600 mph range. Grumman has swept-wing version of its Panther that will have a speed of 800 mph.

• **Assault transports:**

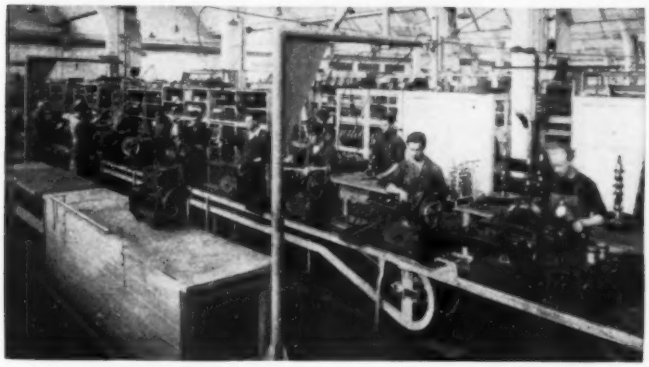
Chase 123, soon to be turned out in quantity at Kaiser-Frazer's Willow Run plant.

Fairchild C-119 Packet, and its detachable cargo pod version, the C-120.

Douglas C-124 Globemaster, with a 50,000-lb payload, and Boeing's C-97 Stratofreight (and its tanker counterpart) with a 68,000-lb payload, are Air Force choices among straight commercial-type cargo planes.

The experimental XC-99, a cargo version of Convair's B-36, has flown with a payload of 100,000 lb.

NORTON COMPANY officials help Carl Ahlstrom, retired 50-year man in the Grinding Machine Div., spread mortar over copper box containing mementos of the firm's 51 years in grinding machine business. Officials are (left to right), Frank W. Smith, vice president, Grinding Machine Div.; Andrew B. Holmstrom, vice president, and Mayor of Worcester, Mass.; and Milton P. Higgins, Norton president. Cornerstone-laying ceremonies July 26 marked start of expansion to 6½-acre single-story factory.



JEEP ENGINE rebuild line at Karlsfeld Ordnance Depot

Army Cuts Engine-Rebuilding Costs At Former German Plane Plant

FRANKFURT, Germany (McGraw-Hill World News)—One of Herman Goering's former aircraft production centers now rebuilds most of the engines, transmissions, and minor assemblies required to support the vast fleet of tanks and trucks operated by American forces in Europe.

A typical month's production of what is now the Army's Karlsfeld Ordnance Depot includes:

Engines: Jeep, Dodge and GMC —2510; engines over GMC size, and tanks—210.

Transfer cases: Jeep, Dodge and GMC — 2550; transfer cases over GMC size, and tanks—15.

Transmissions: Jeep, Dodge, GMC —2225; transmissions over GMC size and tanks—150.

Axles, front: Jeep, Dodge, GMC—1500; axles, intermediate and rear: Jeep, Dodge, GMC—1875.

Steering gears: Jeep, Dodge, GMC —2050.

Propeller shafts: Jeep, Dodge, GMC—6000.

Miscellaneous assemblies: 1575.

• **Cost to rebuild an engine** at KOD is roughly only 25% the cost in the US. Officials at KOD estimate that well over $50 million have been saved over the past five years.

The reclamation project makes possible other savings. For example, one type of operation for reclaiming a Jeep crankshaft cost $6.50, against $24 for a new crankshaft; a 5-ton Federal governor housing costs $28 new, KOD reclaims it for $1.21; a Jeep cylinder block which costs $127 new is reclaimed for $1.60.

Procurement of automotive parts in Germany is another "saving" operation, despite the fact that production facilities for each item must first be developed, whereas in the US shelf items of standard manufacture are used. For example, a certain cylinder sleeve is delivered at KOD for DM5.60 ($1.32), compared with the catalog price of $3.16 in the US. Also, cost of shipment from the US to Germany is eliminated.

The reclamation shops are equipped to do chromeplating, derusting, sandblasting, heat treating, spot welding, butt welding, gas and electrical welding, and metallizing. KOD has the largest metallizing shop in the European command.

Plant Expansion News

• **Clearing Machine Corp.**, Chicago, is constructing a new branch plant in Joliet, Ill., providing 32,000 sq ft of working area on a 27-acre site. Presses for production of cartridge cases, projectiles, aircraft parts, and other military items will be made in the plant.

• **Fairbanks, Morse & Co.**, Chicago, will make engines and pumps in a new plant to be built near Kansas City, Mo. Cost, including machinery and equipment, will be $7,500,000.

• **Accurate Bushing Co.**, Garwood, N. J., has expanded its manufacturing area about 33%. Addition of new equipment and improved plant layout has increased production facilities approximately 100%. New equipment includes fully automatic heat-treating furnaces, high-speed automatic cycling chucking grinders, and new high-speed honing machines.

• **Kaiser-Frazer** Engine Division's Dowagiac, Mich., plant will be tooled for production of components for Wright R-1300 aircraft engines to be built for the Air Force at the Detroit engine plant. The Dowagiac facility will be equipped to perform about 47% of the machining operations required on the AF project.

• **Wendt-Sonis Co.**, Hannibal, Mo., maker of carbide tipped cutting tools, has underway a building program that will add 16,200 sq ft of working space and double the plant productive area.

Critical Materials Stockpile Low

WASHINGTON—Instead of building up the stockpile for a future, all-out war, we have been diverting critical materials from it in order to maintain industrial production at current rates.

Tip-off of trouble ahead came in the new stockpile report to Congress. It showed a dollar gain toward the over-all objective — $700 million nearer the goal now than six months ago. But in terms of really scarce and critical materials, we have lost ground.

How much is secret. But copper is an example. The trend began earlier in the year with a 50% cut in the stockpile take— reported to be from 26,000 to 13,000 tons per month. Next came instructions to suppliers to suspend shipments in the third quarter. Now processors and fabricators are saying that an outright draft on the stockpile for 100,000 tons is necessary to restore inventories and keep industry going at the current rate. Trade guesses are that the government has something over 500,000 tons.

The tungsten situation has been termed "desperate." The take of tin was cut a third in June, and previous goals had not been reached. Acquisition of chromite is lagging despite big imports. Nickel, cobalt and molybdenum have been under terrific pressure, and may have lost some ground.

William A. Sredenschek

A. H. Borchardt

John T. McCarley

Kenneth H. Bergstrom

Names in the News

William A. Sredenschek has been appointed manager of materials and purchasing General Electric Co., Schenectady, N. Y. He assumes managerial duties previously held by **Harry L. Erlicher,** recently-retired vice president in charge of purchasing and traffic. Mr. Sredenschek joined GE in 1921. **J. Herbert Behm** has been named assistant to the manager of special assignments engineering in General Electric's fractonal horsepower motor engineering divisions at Fort Wayne, Ind. Other appointments at GE's Indiana division include: **Lee R. Beard** named division engineer, a-c motor engineering division; **Ray D. Jones** as division engineer, development engineering division and **I. E. Ross** as division engineer, d-c and specialty motor engineering division.

Robert M. Aude has been appointed production superintendent, Monsanto Chemical Co's. plastics division plant at Addyston, Ohio. He has been with Monsanto since 1937.

James MacGregor has been elected president, York Engineering & Construction Co., Pittsburgh. **Charles MacGregor** was elected vice president of the firm; **Philip M. Weber** and **J. Donald Cook** were elected treasurer and secretary respectively.

Philip L. Ward has been named manager, gas turbine division, Solar Aircraft Co., San Diego, Calif. Other Solar division heads named include: **Cyril D. Oberg,** contracts division; **John V. Long,** director of research; **Joseph R. Greene,** experimental division; **W. J. Carrigan,** San Diego plant controller; and **Philip M. Klauber,** research products division.

A. H. Borchardt has been elected a vice president of Worthington Pump & Machinery Corp., Harrison, N. J. He was formerly assistant vice president and manager of centrifugal pump application and sales division. **Herbert E. Gallison** was appointed manager of the industrial mixer sales division and **W. Clifford Mumford** was appointed manager of Worthington's vertical turbine pump sales division.

George A. Lieser has been appointed special sales engineer, and **Earl E. Broadhag** was named development engineer, Liquamette equipment, American Wheelabrator & Equipment Corp., Mishawaka, Ind.

P. N. Jansen has been retained as production consultant, Boeing Airplane Co., Seattle, Wash. He was formerly with USAF Air Material Command and spent 27 years with Curtiss-Wright.

Henry C. McCaslin was appointed executive engineer, and **P. C. Johnson,** assistant executive engineer, Willys-Overland Motors, Inc., Toledo, Ohio. Mr. McCaslin was formerly general purchasing agent and in that position will be succeeded by **Gordon S. Yost.**

Wallace M. Loos has been named manager of mill products, Carpenter Steel Co., Reading, Pa. **Harold A. Brossman** succeeds Mr. Loos as manager of stainless steel sales.

John C. Cotner, president of Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, has been elected director of the machinery division, Society of the Plastics Industries, Inc.

John T. McCarley has been named assistant general manager, Philadelphia division, Yale & Towne Mfg. Co. Mr. McCarley has been with the firm since 1936 and was previously manager of production and in that position he is succeeded by **Kenneth H. Bergstrom. Thomas W. Curtin** was appointed director of purchases for the division, succeeding **W. B. Crossland,** retired.

Anthony J. Zino, Jr. has been appointed domestic general sales manager, Joseph Dixon Crucible Co., Jersey City, N. J.

Hugo J. DeLaCroix and **W. D. Calhoun** have been appointed assistant supervisors of industrial relations for the Youngstown district, Youngstown Sheet & Tube Co., Youngstown, Ohio.

S. D. Flinn was named comptroller, U. S. Steel Supply Co., a subsidiary of U. S. Steel Corp., Chicago. He was formerly works auditor, S. Chicago works, U. S. Steel Supply Co., and in that position will be succeeded by **James J. Riley.**

John Obrebski has been appointed metallurgist, Monarch Machine Tool Co., Sidney, Ohio. Born in Poland, he was a director of the Polish Technical College in Germany during World War II.

Rodger J. Mueller has been appointed manager, Youngstown, Ohio, office of the Falk Corp., Milwaukee, Wis. He succeeds **F. J. Bowers,** who remains in the Youngstown office in an advisory capacity.

C. L. Ross was named sales manager, New York City, Electro-Motive division, GMC, LaGrange, Ill. He was formerly sales representative of the division in the Washington office.

Philip R. Marsilius

Philip R. Marsilius, vice president and secretary, Producto Machine Co., Bridgeport, Conn. and president, Producto Corp., Detroit, has been named chief of the tool, die, and fixture section, Machinery Division, National Production Authority.

Thomas W. Curtin has been appointed director of purchases, Philadelphia division, Yale & Towne Mfg. Co. He succeeds **W. B. Crossland,** resigned. Mr. Curtin has associated with Yale & Towne since 1923.

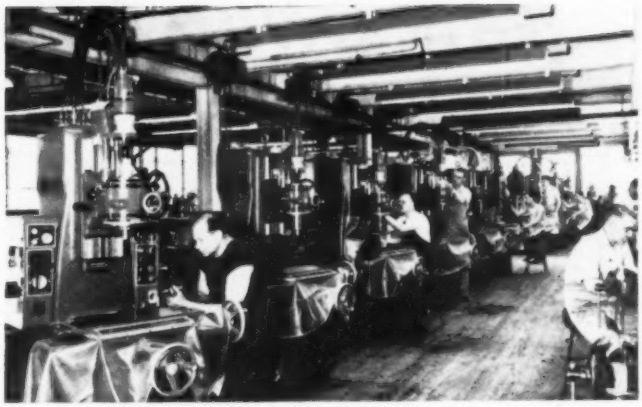
William W. Wellborn has been appointed research engineer of the carbide research & developement department, Firth Sterling Steel & Carbide Corp., Pittsburgh. He was formerly with the Los Alamos, AEC, scientific laboratories, of the University of California.

Don S. Urquhart has been appointed product engineer, Wel-Met Co., Kent, Ohio. He was formerly with the U. S. Graphite Co.

Robert E. Huthsteiner has been elected president of Cummins Engine Co., Inc., Columbus, Ind. Formerly executive vice president, Mr. Huthsteiner succeeds **J. Irwin Miller,** who becomes chairman of the board.

Mrs. Bernice Palmer has been elected president, Universal Gear Corp., Indianapolis. Other Universal executive changes include: **J. Y. Dahlstrand,** named director of engineering and marine sales; **J. A. Wright,** sales manager; **F. J. Keller,** secretary; and **P. J. O'Connor,** works manager.

George Breza has been appointed chief engineer, Mackintosh-Hemphill Co., Pittsburgh.



TEN MOORE JIG GRINDERS go through final assembly and inspection in a section of the new $250,000 addition to the Moore Special Tool Co. plant in Bridgeport, Conn. The 15,000-sq ft addition increases by 25% Moore's facilities for producing jig grinders, jig borers, wheel dressers and tool equipment

Ray F. Sparrow has been elected executive vice president, P. R. Mallory & Co., Inc., Indianapolis. Mr. Sparrow has been vice president in charge of sales since 1931 and in that position will be succeeded by **Harold C. Buell. James L. Wellinger** was elected comptroller of the company.

H. C. Gross has been appointed to the position of chief chemist, Adamas Carbide Corp., Harrison, N. J. He will be in charge of the firm's research and quality control program.

Richard P. Carroll has been named production control manager, Hunt-Spiller Mfg. Corp., Boston. He remains in charge of cost and materials controls.

Robert E. Mitchell has been named field sales manager, Cummins Portable Tool Div., Cummins-Chicago Corp. He was formerly a district sales manager.

Leo Martin and **James W. Hull** have joined the staff of Flexible Tubing Corp., Guilford, Conn. Mr. Martin was named machine design engineer in charge of the company's machine development and design section. Mr. Hull was named chief of chemical laboratory and development section.

Frank J. Byrne has been appointed assistant manager of sales for the steel strapping division, Brainard Steel Co., Warren, Ohio.

Mitchell E. Kapland, vice president, has been placed in charge of sales activities for all four divisions of Cummins-Chicago Corp. Mr. Kapland joined Cummins in 1949 as general sales manager. In 1950 he was elected vice president-sales, business machine division. He was formerly sales manager, Gray Mfg. Co., Hartford, Conn.

Floyd C. Diaz has been appointed superintendent of blast furnaces, Duluth works, American Steel & Wire Co., Duluth, Minn. He has been with the wire company, a U. S. Steel subsidiary, since 1937.

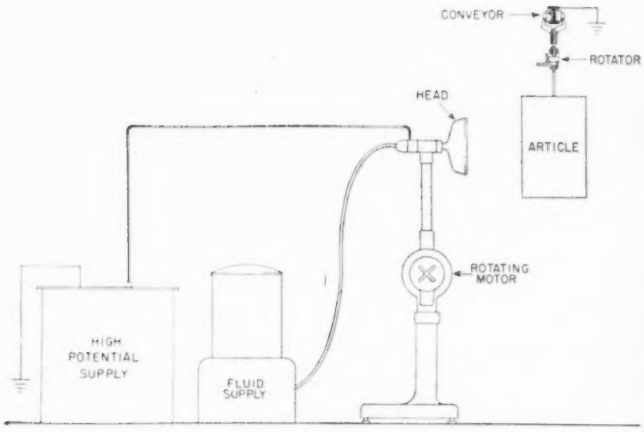
Merten C. Peterson has been named Chicago district manager, automotive division, Warner Electric Brake & Clutch Co., Beloit, Wis. **Elton Miottel** was appointed field engineer for the company, and **R. F. Edgar** was named midwestern district manager of Warner's industrial division.

L. E. Menns has been apppointed Pacific Coast sales manager, Bridgeport Brass Co., Bridgeport, Conn.

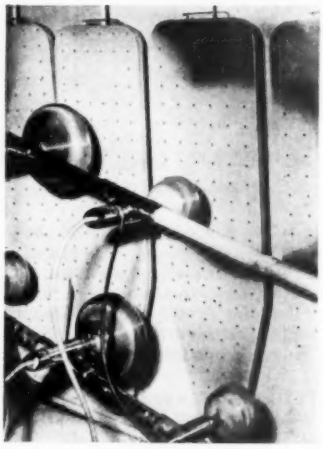
Allan H. Candee has been elected to the honorary grade of Fellow in the American Society of Mechanical Engineers. He has also been elected president, Rochester Engineering Society for 1951-52.

Andrew J. McCoy has been named assistant to the production manager, magnesium wrought products, Madison division, Dow Chemical Co., Midland, Mich.

New Shop Equipment



Eletrostatic system of spraying paint, using a rotating head, is claimed to be as high as 98% efficient. Since there is very little paint over-spray to be eliminated, the exhaust system need only dispose of solvent vapors. Centrifugal force does not enter into delivery of the paint from the atomizing head to the work. The speed of rotation is not sufficient without the electrostatic charge



Metal ironing boards are here being given a coat of white enamel on both sides by the electrostatic-spray process. Saving in paint costs are up to 50% over hand methods

Electrostatic Paint Spray is 98% Efficient

The No. 2 Electro-Spray process eliminates the pneumatic spray gun used in most installations and in Ransburg's first electrostatic system. The radical new gun consists of hollow cone-shaped heads through which the paint is flowed at low pressure by positive-displacement pumps.

The article to be coated is carried by conveyor past the gun. Paint is metered at a constant rate to the apex of the head. Rotation of the head spreads the paint uniformly over its inner surface, causing the material to flow evenly to the outer edge. A high-potential source creates a strong electrostatic field between the head and the work, which is grounded by the conveyor. The force of this field tranforms the paint into a spray of fine, highly charged particles that are pulled to the grounded piece.

The heads are rotated at 200 to 250 rpm, with the paint pumped into their centers. With the paint spread over the entire inner surface by the head rotation, the electrostatic force has a large area on which to work. Heads developed so far range from 1 to 18-in. dia depending upon the area to be covered. Thickness of coat spread by each head depends upon the speed of the conveyor and upon the rate at which paint is pumped to the head. It is also affected by the atomizing area inside the head cone.

A surprisingly high paint-application efficiency is claimed for this process: Figures quoted are as follows: Efficiency of new No. 2 electrostatic process—95-98%. The original Ransburg process, using conventional spray guns—70-75%. Efficiency of the best hand-spray process, in water-curtained booth is about 50%. It is claimed that most automatic equipment without electrostatic charging is below 50%.

Electrical characteristics of the No. 2 process are about the same as for the No. 1, averaging 90,000 to 100,000 v and 0.1 to 0.2 milliamperes.

To avoid grounding atomizing heads, paint is delivered to the head through plastic tubes, and the driveshaft connecting the head to the motor (for rotation) is an insulating plastic rod. Where metallic paints are used, it is also necessary to insulate the pump and the paint-supply tank from the ground.

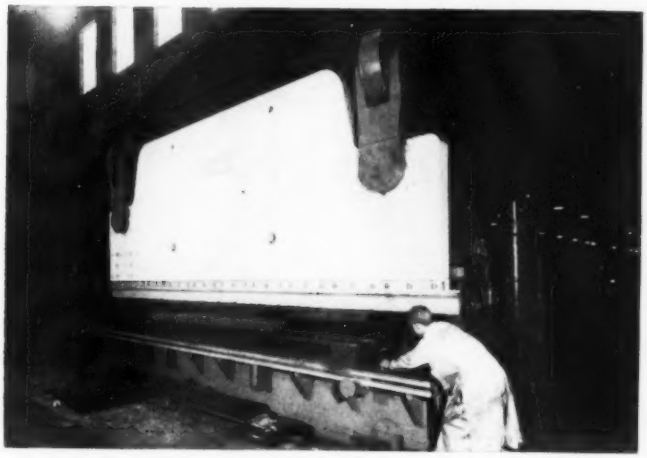
Heads can be mounted to deliver paint in any direction, upwards, downwards, or sideways. In painting automobile steering wheels, for example, two heads are used. One is mounted to spray upward, the other downward, with the steering wheels rotating about a vertical axis on the conveyor.

Ransburg Electro-Coating Corp., 1234 Barth Ave., Indianapolis 7, Ind.

Battery charger for industrial trucks is operated on the selenium-rectifier principle. The charger is claimed to give maintenance-free operation, save power, and prolong battery life. These results are accomplished because of an automatic controller, which governs the amount and time of charge and because moving parts have been eliminated. The charger is for units with up to 55 ampere-hr capacity.

The Yale & Towne Mfg. Co., Philadelphia Div., Philadelphia 15, Pa.

Materials and Parts

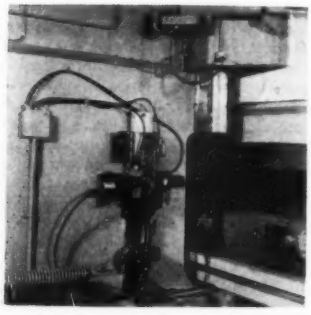


1000-ton Verson pressbrake has a GE device to permit the ram to be operated at a preselected tilt or to be held level throughout stroke

GE Photoelectric Control Levels Ram on Verson Press Brake

A General Electric electronic system enables the ram on this press brake to be held completely level through its stroke, or to be tilted down to a thousandth.

The brake is hydraulically operated. The ram is actuated by two independent hydraulic cylinders supplied from separate matched pumps.



Photoelectric device is used to control the ram motion. Note the barrier which drops in front of the light source if ram is not level

A reversible booster hydraulic pump is used to transfer oil from one line to another to maintain position synchronization of the ends of the ram.

The booster pump is driven by a motor supplied by an amplidyne generator, which is, in turn, controlled by the photoelectric system. Any tilt of the ram raises or lowers a barrier suspended between the cell and the light source. Movement of this barrier as much as a thousandth of an inch results in automatic correction through altered speed and direction of the oil flow from the transfer pump.

Vertical micrometer adjustment of the electronic unit permits the ram to be operated at a selected degree of tilt. The ram control is claimed to be more efficient, more sensitive and easier to operate than the customary mechanical tie or valve-and-limit switch methods. The development model of the new press brake has been fully tested and is now being used by Verson in its own manufacturing operations.

Verson Allsteel Press Co., Chicago, Ill.

...INCLUDING

Oxyacetylene process to remove excess metal and burned-in sand from castings ..... page 144

Swiss-made automatic machine grinds small and medium threads on taps, screws, etc. ... page 144

Cold welding of non-ferrous metals through the use of cold pressure alone has been improved in technique ..... Page 145

Optical straightedge for contour measuring uses a beam of light as a reference line ..... page 145

Automatic-screw machine has longitudinal feed imparted by a sliding headstock ..... page 146

Tie bars strengthen frame on 24- and 32-oz. injection molders for thermoplastic material page 148

Clamping fixture for millers provides a force of 10,000 lb without use of hydraulic pump or high-pressure valves ..... page 150

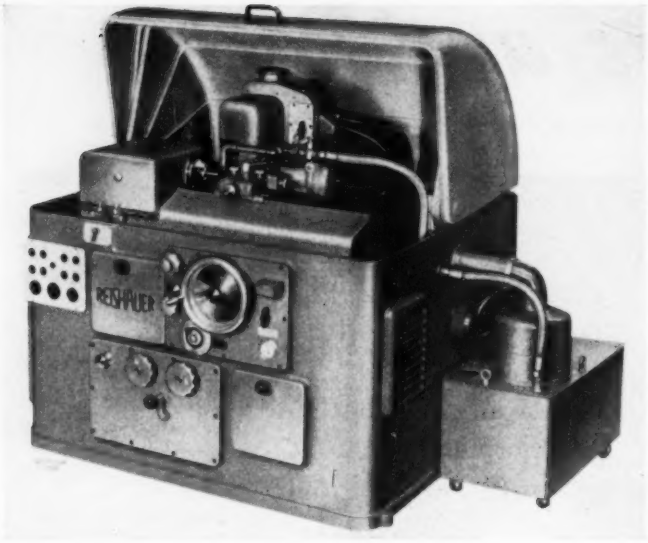
Hydraulic forming and drawing press is controlled by a fast-acting 4-way valve ..... page 154

Optical comparator magnifies five fold to a maximum of 30 in. on screen ..... page 156

...and in Sept. 3

Gear hobber can cut gears at a hob-spindle speed of 1000 rpm. Initial cut on gear is a plunge, followed by traverse of work across hob face

Method-X machine is revealed—showing how electrodes cut through carbides, speeds and feeds, and theory behind it



Wheel Trued Automatically On Swiss Thread Grinder

The Reishauer automatic machine grinds very small and medium threads on straight- or spiral-fluted taps, micrometer spindles, worms, thread gages, screws, studs, etc.

Designed for high-speed production, the machine operates on the longitudinal-feed principle, employing a single-thread grinding wheel, providing maximum accuracy for grinding small pitches. Down times are limited to changing the work. The grinding wheel is trued automatically during the return stroke of the work table. Measuring time is eliminated, as the machine grinds to size. Only the wear of the truing diamond must be checked from time to time and adjusted by hand.

The grinding slide, carrying the grinding head, performs the movements for the feed and relief grinding. The head can be set in the helix angle. The longitudinal movement of the work corresponding to the desired pitch is accomplished by the table slide.

The grinder is made by the Reishauer Tool Works, Ltd., Zurich, Switzerland.

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

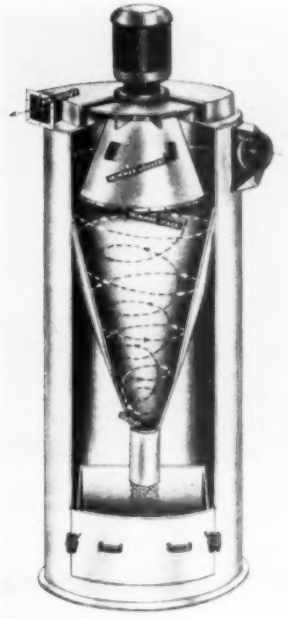
Oxyacetylene Process Removes Excess Metal, Burned-In Sand

Sand encrustations, fins, pads, chaplets, and other forms of excess metal can be removed from castings quickly, easily, and economically. The means is an oxyacetylene method developed by Linde Air Products Co.

Called Powder-Washing, it uses a special blowpipe, equipped with external powder-washing attachment. With this apparatus, an iron-rich powder is fed through oxyacetylene preheat flames into a low-velocity oxygen stream where it burns and produces superheated liquid iron oxide. Heat from the combustion of the powder and from the slag simplifies and speeds the removal of metal and metal-sand mixtures. Wherever the powder-feed is directed against a casting, the metal surface is brought quickly to kindling temperature, and then is oxidized and blown away by the oxygen stream.

After Powder-Washing, the surfaces of castings are left smooth, clean, and to close tolerance. There is no undercutting and no torn metal.

Linde Air Products Co., A Div. of Union Carbide & Carbon Corp., New York 17, N. Y.



Area Dust Control Without Central System

A unit dust-control system, designed to operate independently and provide maximum dust recovery over a wide range of volume at low operating cost, is now available from the Day Co. The units are said to be practical in plants where central dust-control systems are not feasible and for points too remote from a central system.

The effective air-dust separation which takes place in the unit is explained by the manufacturer as a patented two-stage action utilizing internal skimmers. The dust-laden air enters at the side of the unit and spirals down to the cone outlet. As the cleaned air spirals up through the internal skimmer stack, extra-fine dust particles, carried upward with the outgoing air, are confined by the tapered stack. Here they are skimmed off and returned to the dust outlet.

The unit operates at 6-in. external static pressure, and the fan can be discharged at any 45° interval. Units are available in 4 sizes from 500 to

2000 cfm, and are furnished with or without secondary filters.

The Day Co., 810 Third Ave., NE., Minneapolis 13, Minn.

GE's Vertical Motors Use Squirrel-Cage Rotors

Vertical, solid-shaft capacitor motors with standardized mountings are now being built by GE's Small & Medium Motor Divisions.

An addition to the company's Tri-Clad integral-horsepower, single-phase, capacitor motor line, the motors are availabile in ratings from $\frac{3}{4}$ to 5 hp.

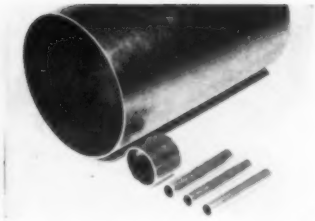
Tri-Clad construction provides the motors with protection from physical damage, electrical breakdown, and operating wear and tear. Dimensions of the Type-P base, machined to NEMA standards, are the same as those of polyphase motors of the same size, permitting interchangeability without modification of the mounting. The capacitor motors use squirrel-cage rotors rather than brushes or commutators; this provides quiet operation without causing radio interference.

As accessory equipment for use with motors rated at 2 hp or less, an automatic thermal protective device is offered which disconnects the motor from the line when the limiting temperature is reached because of overload, high ambient temperature, inability to start, etc.

Principal application of the vertical motors is on jet pumps and other assemblies supplying water. Normally furnished as part of the complete pumps, the motors can be used for outdoor operation.

Small & Medium Motor Div., General Electric Co., Schenectady, N. Y.

Microphotograph of a butt weld, showing molecular penetration. Tensile failure occurred in the parent metal, as seen at left



Examples of cold-welded tubing from sheet or ribbon stock. It can be drawn, bent, flared, and shaped

Cold Copper Butt Weld Stronger Than Parent Metal

Koldwelding is a method of welding non-ferrous metals by pressure without the use of heat or electricity. It requires only simple tools and permits the use of unskilled operators. It was introduced a year ago, but has since undergone considerable development.

A new technique is the cold butt-welding of rods and wires, such as aluminum-to-aluminum, aluminum-to-copper, and copper-to-copper. The butt weld has proved to be stronger than the parent metal. Microphotographs reveal molecular interpenetration between the two butt-welded sections.

A tackweld method was developed for making electrical connections and for attaching flat sheets or tubing to a rod. Tests are reported to have shown that the resistance of the weld is less than the resistance of the original conductor.

Tubing can also be made from flat ribbon and sheet stock by the Koldweld process. With this process, tubing smaller than 1/8-in. O.D. has been produced. The tubing has smooth inside and outside surfaces, and is somewhat stronger than that made by the original process, which left a small rib along the line of the weld.

Aluminum water kettles are being made by the Koldweld technique. The body is made of two symmetrical halves, punched and drawn from flat-sheet aluminum stock. The two halves are then welded by single-pressure operation, or by a rotary tool applied along the center joint.

Koldweld Corp., 10 E. 40th St., New York 16, N. Y.

Optical Straightedge For Contour Measuring

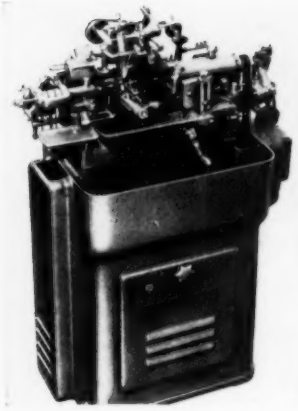
By utilizing a beam of light as a straight-line reference, deviations of supposedly flat surfaces, as small as ±0.00005 in., may be measured. This is made possible by an optical straightedge, consisting of a feeler microscope with built-in illumination, which rides along the surface under examination.

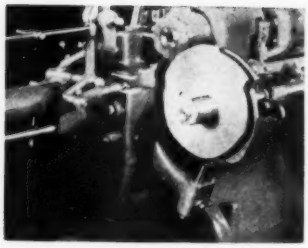
Made in standard lengths of approximately 3, 5, 10, and 13 ft, the housing rests on two blocks and the feeler, which includes the optical system, slides on the work surfaces. The errors, observed through the microscope, are indicated by the relative position of two indices. The distance between these indices is converted into linear measurement by reference to a micrometer thimble.

The surface contour may be graphically recorded by accessories attached to the equipment. Deviations, enlarged by 1000, are traced for permanent record on coordinate paper as the feeler is moved from one end of the housing to the other.

The unit is said to be both quick and accurate in checking deviations in most surfaces.

F. T. Griswold Mfg. Co., 505 W. Lancaster Ave., Wayne, Pa.





Axial movement of headstock is from cam-operated mechanism called the Radiax. Chucking can be done at any headstock position without new adjustment

Swiss automatic-screw machine has sliding headstock for axial feed. The work is guided by bushing right in front of tools

Sliding Headstock on Tornos High-Speed Automatic Screw Machine

Stock capacity	7/16 in.
Spindle bore	½ in.
Spindle speed changes	20
Range of speeds	1050-10,000 rpm
Camshaft speed changes for each spindle speed	40

The R10 is one of eight models of the Tornos line of high-speed sliding-head automatics. Like the others, the headstock moves longitudinally in order to impart actual feed to the bar revolving with the spindle. The bar can then be guided in a bushing right in front of the tools. This enables turning long and slender parts with accuracy and close concentricity.

Axial movement of the headstock is derived from an adjustable cam-operated mechanism called the Radiax. Chucking can be operated in any position of the headstock without new adjustment. The belt-driven spindle runs in an adjustable needle bearing at the front, and ball and thrust bearings at the rear.

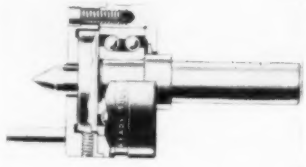
The five toolbits turn the work by combined radial infeed of the tools and the actual feed of the rotating bar. The use of form tools is usually avoided. Five radial toolholders—two mounted on a cam-controlled rocker—come as standard. Six toolholders on six-inch independent slides can be had on special order. All tools are set by micrometer screws. Vertical tools are clamped with a single screw and rocking clamp. The tools can be set very close to the work—thus avoiding vibration.

A horizontal attachment base with T-slots avoids new centering whenever an attachment has to be put back again. Some of the Tornos attachments which can be mounted are:

Single-spindle threading or drilling attachment; three-spindle combined drilling and threading attachment; slotting attachment, safety stopping device to guard against faulty threading and slotting; a unit for back drilling; copying attachment; camshaft accelerator operated by a friction clutch; and a revolving guide-bush holder.

The Tornos machine is made in Switzerland and imported. Turning length with flat cam is 2 3/4 in. With bell cam it is 4 in.

Carl Hirschmann Co., 30 Park Ave., Manhasset, N. Y.



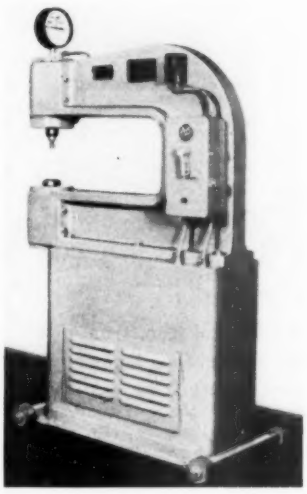
Ready Floating Center For Hand-Reamer Grinding

Floating center is especially designed for the grinding of expansion hand reamers on universal tool and cutter grinders.

The expansion plug of the reamer is first adjusted so that the highest micrometer reading is from 0.002 to 0.004 in. over the nominal size. The swivel table is then adjusted to produce the desired lead. Each blade is then backed off, leaving a sharp cutting edge. The cutting edge is then stroked with an India oilstone to remove grinding burrs. This procedure is said to eliminate a cylindrical grinding operation.

The centers are available in various tapers or straight-shank sizes and can be adapted to any universal tool and cutter grinder.

The Ready Tool Co., 55½ Iranistan Ave., Bridgeport, Conn.



Deep-Throated Hardness Tester Is Hydraulically Operated

Designated Model AP-1, this C-frame machine having a throat depth of 24 in., incorporates several unusual features. It is mounted on wheels for easy positioning over a conveyor. The lower anvil is the top of a hydraulic piston which rises as the load is applied to take the pressure off the conveyor and also keeps the stock level while tests are being made.

Machines are made to order so that anvil height will conform to customer's conveyor height. The maximum vertical opening between ball penetrator and anvil is 4 in.

The operating cycle is controlled by a simple snap switch located on the side of the machine. The switch is turned to the "on" position to apply the 3000 kilogram load, turned "off" to release it. The diameter of the impression is conventionally measured with a Brinell microscope.

Over-all dimensions are approximately 41 in. deep and 19 in. wide. Height depends on anvil height specified.

Steel City Testing Machines, Inc., 8853 Livernois St., Detroit 4, Mich.

Continuous production

with a CHIP-TOTE

Machine tool production increased through constant removal of chips, turnings and borings.
Eliminates shut-down and reduces waste handling.

The CHIP-TOTE conveyor continuously removes wet or dry chips, turnings and borings from multiple-spindle or automatic machines. Speed of operation can be synchronized with the metal-removing capacity of any standard or special machine.

The scrap material is channeled onto the May-Fran hinged-steel conveyor belt, carried horizontally until clear of the machine's working mechanism, and then transported up a steep incline for discharge into tote box or onto a carry-off conveyor system.

A CHIP-TOTE conveyor eliminates shut-down of vital equipment, stops waste of skilled workers' time, and provides for continuous production. Let a May-Fran CHIP-TOTE solve your production problems . . . automatically and efficiently.

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MAY-FRAN ENGINEERING, Inc.

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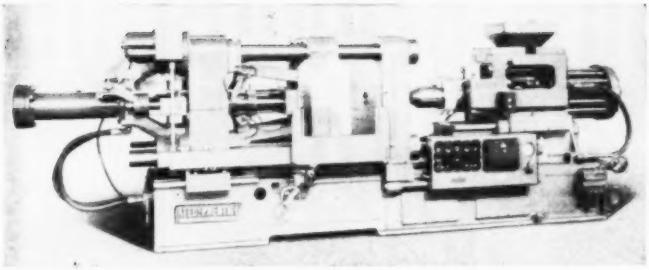


Tie Bars Strengthen Frame On Reed-Prentice Injection Molders

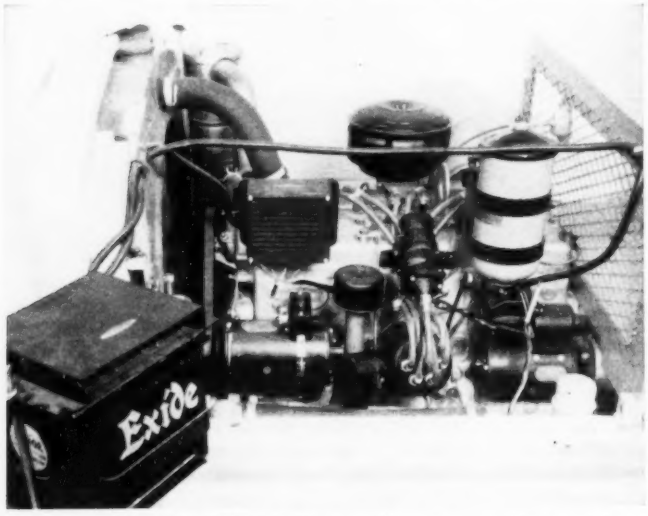
The latest 24- and 32-oz plastic injection molding machines in this line have tie bars replacing the former frame construction. Designated the 600-T Models, the machine will plasticize 125 and 150 lb, respectively, of thermoplastic material per hour.

The mold-locking mechanism develops 600 tons of clamping pressure. Stroke is 24 in. normally or can be shortened for thin molds. The mold is adjusted by a link mechanism operated by four motor-driven nuts on the tie bars.

A central control panel at the front automatically controls movement of the die plate and plunger. Size of the die platens has been increased to 45 x 54 in. providing a casting area of 300 sq. in. The movable die plate slides on the four 6-in.-dia. tie bars and moves on hardened steel ways.

The heating cylinder is mounted on vertical ways to permit easy removal. It has a copper core spreader. Hydraulic and electrical interlocks on the front door assure safe operation. Motor and hydraulic equipment is conveniently grouped at rear.

Reed-Prentice Corp., 677 Cambridge St., Worcester 4, Mass.



SPARK-ENCLOSED GASOLINE TRUCK provides maximum safety operation in gas- and dust-laden area. Designated Underwriter's Laboratories Type GS, the truck uses a cover over the battery terminals, totally enclosed generator, enclosed distributor and coil, and high-tension wires enclosed in flexible metal conduit. Voltage regulator (near base of radiator hose) is also totally enclosed. Behind radiator hose is condenser-type muffler. Oil-bath air cleaner has a back-fire arrestor. All spark plugs are shielded.— ***Philadelphia Div., Yale & Towne Mfg. Co., Philadelphia 15, Pa.***

Tachometer Monitors Speeds of Many Machines

Speeds of many machines are now measured from one convenient location, with the Metron tachometer, which employs a simple machine selector knob. Quick, accurate speed tests and comparisons are easily accomplished, even when the indicator is located up to 1000 ft from any of the machines.

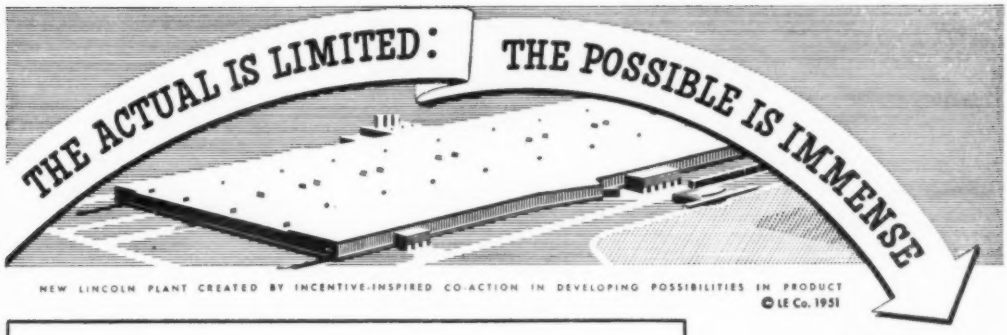
A wide selection of over 50 standard full-scale range markings are available, all with easy-to-read graduations. Direct reading in any units, such as rpm, fpm, in./sec, etc, from any speeds between 1/10 rpm and 100,000 rpm are offered by use of various heads. No speed-changing drives are necessary. Connections between heads on the machines and the indicator are made by ordinary electric wiring.

Rugged design and sealed construction assures foolproof and dustproof operation. The meter is mounted in sponge rubber, and overspeeding does not damage the indicator. No limited life components are employed.

Stable calibration, initially made at the factory, can easily be adjusted in the field to accommodate extraordinary conditions. Universal mountings for semi-flush panel, or bracket installation is offered in all of these Series-42 indicators.

A new tachometer indicator, the Series 42P, has three speed ranges. A fixed-installation instrument, it has a particularly wide range. Simple rotation of the range knob instantly selects one of the three ranges.

Metron Instrument Co., 432 Lincoln St., Denver 9, Colo.



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

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SAVES 94% WITH WELDED STEEL

Machine designs that utilize the economies of welded steel are always lower in cost. As shown in the development of this typical machine part, substantial production savings are possible because:

Steel costs less per pound and fewer pounds are needed. The initial cost-saving advantage is 7 to 1 with steel, considering strength and safety factors alone.

Approaches to efficient product shape are endless. Stronger materials themselves can be more easily concentrated in the load-carrying areas, giving greater strength, more rigidity per pound of metal. Unlimited combinations of steel shapes can be utilized, enabling lower cost manufacture with a minimum of shop equipment.

Get the facts now. Your Lincoln Welding Engineer will show how your products can be fabricated with less metal and at lower cost. Simply call or write.

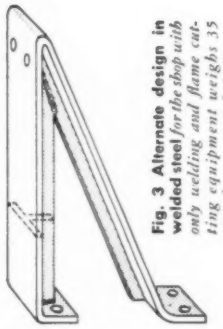

Fig. 3 Alternate design in welded steel *for the shop with only welding and flame cutting equipment weighs 35 pounds . . . costs only $4.70 . . . a saving of 48% over Figure 1.*

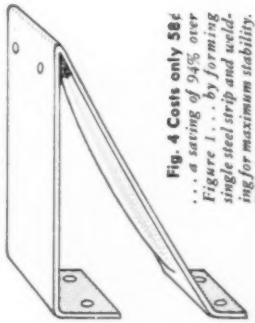

Fig. 4 Costs only 58¢ . . . a saving of 94% over Figure 1 . . . by forming single steel strip and welding for maximum stability. Weighs only 9 pounds.

the ACTUAL

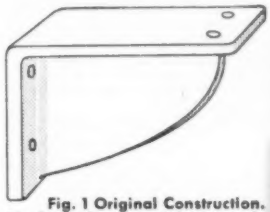

Fig. 1 Original Construction. *Machinery bracket weighs 39 pounds. Has ¼" and ⅛" sections. Requires milling and drilling. Costs* $9.10.

increasing the YIELD

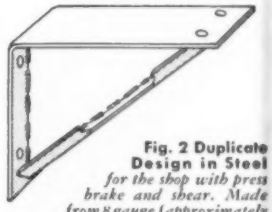

Fig. 2 Duplicate Design in Steel *for the shop with press brake and shear. Made from 8 gauge (approximately ⅛") sheet . . . saves 27 pounds of metal.* Costs $5.13 less than original construction.

the IMMENSITY of the POSSIBLE a saving of 56% in cost

PROGRESSIVE DESIGN CUTS COSTS FURTHER

Machine Design Studies available to designers and production men. Write on your letterhead to Dept. 107,

THE LINCOLN ELECTRIC COMPANY

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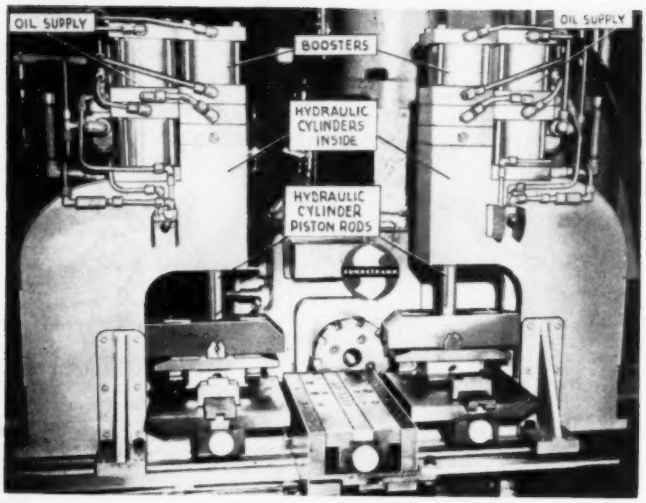
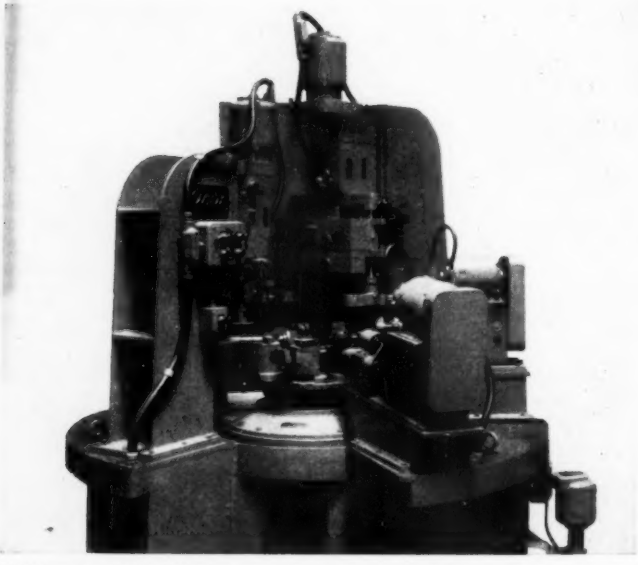


CLAMPING FIXTURE for the Sundstrand Rigidmil milling machine provides a total force of 10,000 lb without the use of hydraulic pump or high-pressure valves. Operation is by plant air and, at 80-psi air input, a clamping pressure of 2000-psi hydraulic pressure for 2½-in.-bore hydraulic cylinder is obtained. A standard Miller B4 Air Miser fluid-pressure booster with a ratio of 25 to 1 drives a standard Miller (2000 to 3500-psi) hydraulic cylinder. The fixture has two identical clamping units facing each other for reciprocal milling of small pieces. Work capacity is 20 in. sq. x 5 in. thick. — *Planet Products Corp., Cincinnati, Ohio*



MILLING, DRILLING AND SLOTTING machine processes control plugs for gas stoves. Production is between 500 to 580 parts per hour at 100% efficiency. The machine consists of 5 No. 1 automatic camfeed units, mounted at suitable angles around a 20-in. automatic index table. All units are arranged on a fabricated steel base which contains coolant system and chip disposal. There are four drilling operations, two milling, and one chamfering. Rotary motion of work fixture is by rack and pinion. — *The Avey Drilling Machine Co., Inc., Cincinnati 1, Ohio*

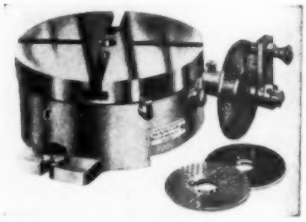
High Ohms-Millivolt Ratio In Gordon Pyrometer

A general-purpose, low-temperature, portable pyrometer is said to facilitate temperature determination below 800 F in production-line laboratory, or field service.

The self-contained instrument is precision built and enclosed in a well-balanced, finished metal case with double-strength glass window. An integral, easy-grip handle makes it convenient to use in any position. A choice of 4 calibrations allows effective use of the scale range.

Available for use with the instrument are two needle thermocouples, a ribbon thermocouple, a surface-tip thermocouple, and other specially designed thermocouples and extension arms. These are easily interchangeable and recalibration is unnecessary. The instrument will easily measure the surface temperature of stationery and revolving rolls, and molds and dies, etc.

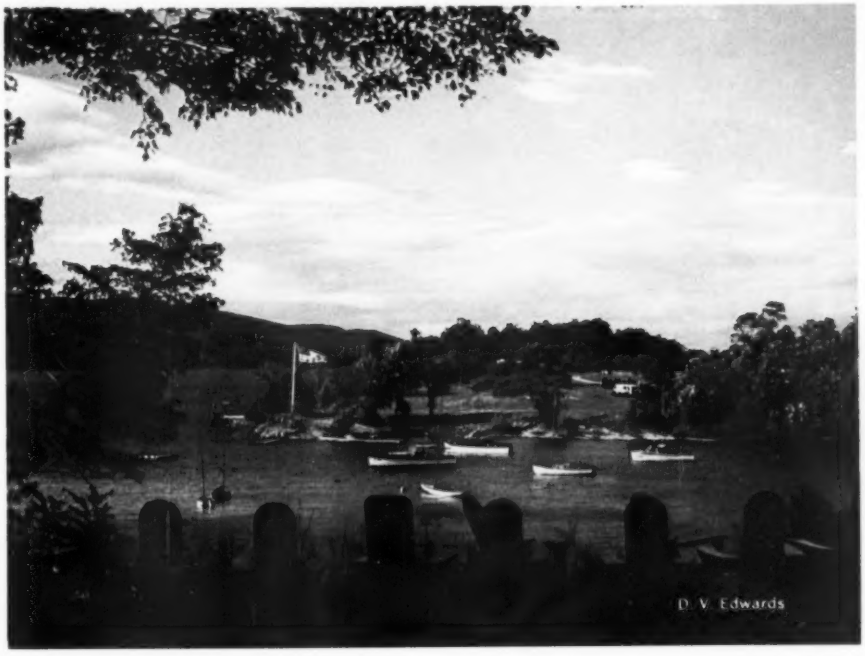
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 20, Ill.



Marvin Rotary Table

The Marvin table can be used on a bench mill, shaper, or drillpress. It is furnished with three index plates, each of which has six circles of holes. It locks from the center preventing tilting. A cast-iron worm wheel and hardened and ground worm provide a 40 to 1 ratio. The worm can be disengaged. The cast-iron table is $2\frac{5}{8}$ in. high and has a dia. of 6¼ in.

Marvin Machine Products Inc., 411 Ford Bldg., Detroit 26, Mich.

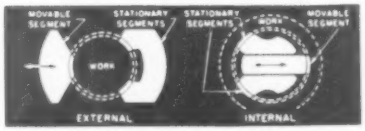


*What's in Vermont this month?**

AN ENTIRELY NEW PRINCIPLE SPEEDS THREAD INSPECTION

A new principle of thread inspection has been developed that is *visual*, and so fast as to obsolete most conventional production gaging methods. It is more accurate and, even with inexperienced help, is 4 to 5 times faster than the ring and plug gage system. It eliminates threading and unthreading the part with the gage threads. It shows instantly the size, presence of burrs and out-of-roundness, and the accumulated inaccuracies of pitch, lead, diameter and thread form. It shows variation between production threads and a known master.

This new principle employs three ground thread segments — two stationary and one movable by a control lever. Gages, using this principle, are available to inspect internal or external threads



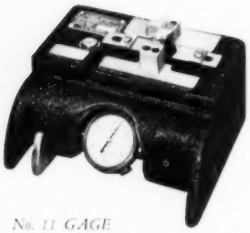
from $\frac{5}{16}$" to 4". Attachments make possible instant reading of concentricity of an O.D. with the P.D. or squareness-of-face with P.D.

* Remember . . . It won't cost to inquire!

Bryant Chucking Grinder Company in Springfield, Vermont, U.S.A.

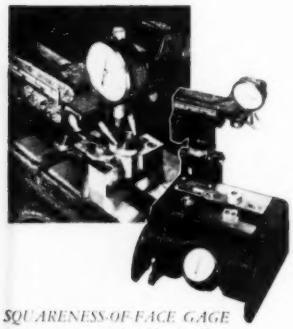
FOR CHECKING THREAD ASSEMBLE-ABILITY

The Bryant Line of Thread Gages



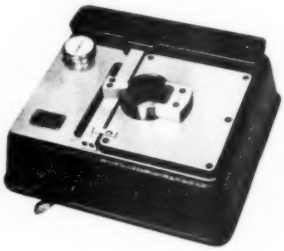
No. 11 GAGE
internal or external from $\frac{3}{16}$" to 1"

These Bryant Thread Gages give a visual quantitative reading of accuracy within tolerances, or accumulated inaccuracies of lead, pitch diameter and thread form, or the presence of burrs. For the first time, threads may be checked for *assemble-ability* into known classifications for fit. Bryant Gages are built in many standard and special models to handle the inspection of a wide range of threaded parts, both internal and external. Attachments may be provided for checking squareness of face to show relationship of face to pitch diameter. Segments for both external and internal gages are furnished to either GO or NOT GO thread form to "W" tolerances, thus accommodating all classes of fits. Capacities of standard bench models are $\frac{1}{8}$" to 5" internal and $\frac{3}{16}$" to 5" external; portable models are $\frac{7}{16}$" to 3" internal. Write the factory for full information.



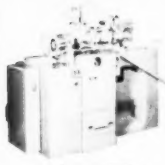
SQUARENESS-OF-FACE GAGE
for No. 11 Gage

No. P-11 PORTABLE GAGE
internal from $\frac{7}{16}$" up

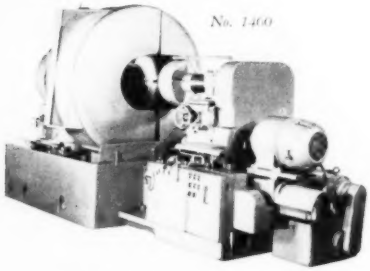


No. 2 and No. 3 GAGE
internal and external from 1" to 5"

FOR HOLE GRINDING



No. 2209-D



No. 1460

The Bryant Line of Precision Hole Grinders

Since 1909 the Bryant Chucking Grinder Company has specialized in building precision grinders for finishing holes where the part can be held in a chuck. Bryant equipment has always been outstanding for the advanced engineering that has gone into the product and for the research and development which stands behind the engineering. The purpose of the Bryant machines has been to finish holes to maximum precision at a minimum of cost both on the production line and in the tool room. Bryant machines are available to finish holes from thirty-thousandths of an inch to five feet in diameter.

Bryant Chucking Grinder Company in Springfield, Vermont, U.S.A.

MUELLER BRASS CO.

600 series a better bearing bronze containing no hard-to-get tin

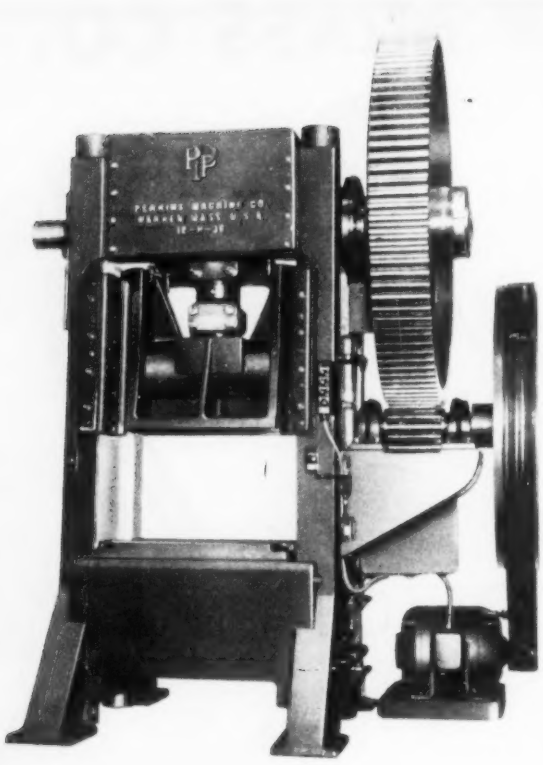
If you use gears, connecting rods or other parts of bearing metal in your products, it will pay you to investigate Mueller Brass Co. "600" series, a forgeable bronze that *contains no critical tin.* This bearing metal outperforms phosphor bronze and other bearing metals and will save you money in your applications. "600" series bearing metal can be forged into relatively complicated shapes and produces a forging of close-grained homogeneous structure impossible to get in a casting. The forged shape is closer to finished size than a casting and requires less machining. "600" series alloys have a low coefficient of friction, a tensile strength 2½ times greater than cast phosphor bronzes and a high resistance to corrosion. "600" has a 25 year record of outstanding performance on some of the toughest bearing applications. There is a "600" series alloy with the properties to fit your bearing metal needs . . . write today for further facts.

Four typical parts forged from Mueller Brass Co. "600" series Bearing Bronze.

MUELLER BRASS CO.

PORT HURON 18, MICHIGAN

64

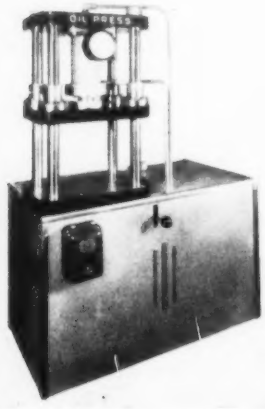


Perkins Straight-Side Press

The Model 12-H-36 straight-side, single-crank press has a large bed and is sturdily built. The 36x36-in. bed accommodates a large variety of work and there is good accessibility for changing dies without trouble.

The main bearing has an 8-in. dia. Capacity of the machine is 200 tons; operation and upkeep are economical.

Perkins Machine Co., Warren, Mass.



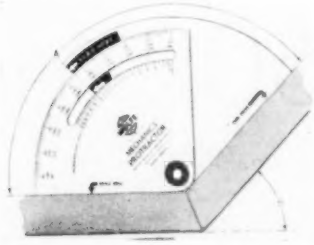
Hydraulic Forming And Drawing Press

Capacity	50 tons
Platen area	25x20 in.
Stroke	10.5 in.
Maximum daylight	20 in.
Pressing speed	55 ipm

The movement of the press is controlled by a fast-acting, four-way valve, and the ram is down-moving, double-acting. The frame is of four-rod construction. The drawing cushion operates from shop air lines, with a piston hydraulic pump driven by a 10-hp motor.

Drawing can be done to a maximum depth of 5 in. and the largest blank the pressure pad will accommodate is 16x16 in. For single-acting operations, the press will handle a die with maximum dimensions of 18x20 in. without overhang.

The Oilpower Engineering Co., 1067 Davis Terrace, Schenectady 3, N. Y.



Protractor for Worker's Measuring Problems

The "Mechanic's Protractor" offers a practical solution to on-the-job angle-measuring problems up to 180°.

At one setting, 3 readings can be obtained: reading outside angles, such as angles of bend or deflection; reading inside or inclusive angles; and will give inches-per-ft against degrees, up to 24 in. per ft.

Difficult angles can be measured with this protractor by using it in conjunction with a bevel.

It is a handy pocket size, 3 5/8 in. long and weighs only 1½ ounces. Made of vinylite plastic, it is not affected by grease or water and will not burn, warp, or become illegible.

Interstate Sales Co., 123 E. 18 St., New York 3, N. Y.

Multi-Purpose Coolant Lubricant

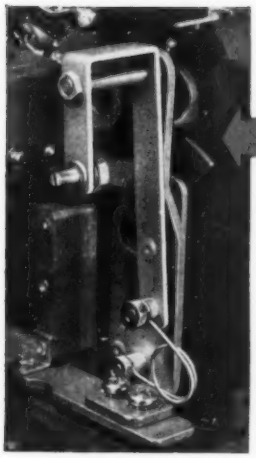
Emulsifier STH, a water-soluble, metalworking coolant lubricant, is said to be stable and efficient for use in cutting, grinding, drawing, and stamping operations.

Emulsifier STH is not an ordinary soluble cutting oil. It is based on a unique family of chemical compounds possessing unusually good lubricating qualities because of a high affinity for metals.

The emulsifier is for use in all types of metalworking machines which employ coolant recirculating systems properly sealed for handling water emulsions. It is being used with automatic chucking machines, hand screw machines, turret lathes, grinders, mechanical saws, drill presses, and millers. Drawing and stamping jobs are also being done successfully by dipping the sheet in diluted STH before working.

Product Development Dept., General Aniline & Film Corp., Easton, Pa.

5 WALDES TRUARC RINGS ELIMINATE 4 TOOLING OPERATIONS... SAVE 22½¢ PER 100 UNITS

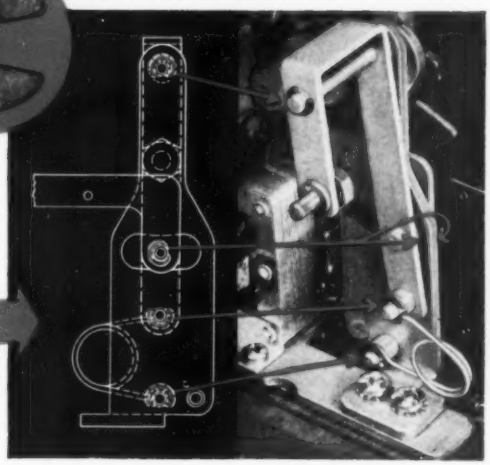


OLD WAY

Unit requires 4 hex head nuts, 4 washers, 4 shoulders, threading of 4 shafts. Clearance and end-play specifications necessary... constant maintenance.

NEW WAY

Just 5 Truarc "E" Rings set into predetermined grooves secure parts permanently. Assembly is simple, economical. No clearance specifications ...no maintenance!



5 Waldes Truarc Retaining Rings in one assembly of the Dictaphone Time-Master dictating machine brought great savings to Dictaphone Corp., Bridgeport, Conn. And this is just one of three different applications where Truarc Rings cut material, tooling and assembling costs for this product.

Redesign with Truarc Rings and you too will cut costs. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better job of holding parts together.

Truarc Rings are precision-engineered...quick and easy to assemble and disassemble. Always circular to give a never-failing grip. They can be used over and over again.

Find out what Truarc Rings can do for you. Send your blueprints to Waldes Truarc engineers for individual attention, without obligation.

Waldes Truarc Retaining Rings are available for immediate delivery from stock, from leading ball bearing distributors throughout the country.

REDESIGN WITH 5 TRUARC "E" RINGS BRING THESE BIG SAVINGS...

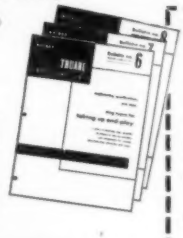
Assembly time per unit using screws and washers . 24 seconds

Assembly time per unit using Truarc Rings . . . . 15 seconds

- Time saved per unit with Truarc Rings . . . . . 9 seconds
- Eliminates skilled labor milling and threading operations
- Eliminates maintenance
- **TOTAL MATERIAL AND LABOR COST SAVINGS PER 100 UNITS . . 22½¢**

Be sure to see the Truarc display, Booths 215 and 216 at the Pacific Electronic Exhibit, August 22, 23, 24

SEND FOR NEW BULLETINS



WALDES TRUARC

REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS ARE PROTECTED BY THE FOLLOWING PATENT NUMBERS: U. S. PAT. 2,302,040; 2,420,921; 2,411,761; 2,487,803; 2,487,802; 2,481,308 AND OTHER PATS. PEND.

Waldes Kohinoor, Inc., 47-16 Austel Place AM-083
Long Island City 1, N. Y.

Please send Bulletins 6, 7 and 8—giving engineering specifications for all types of Waldes Truarc Rings.

Name_____

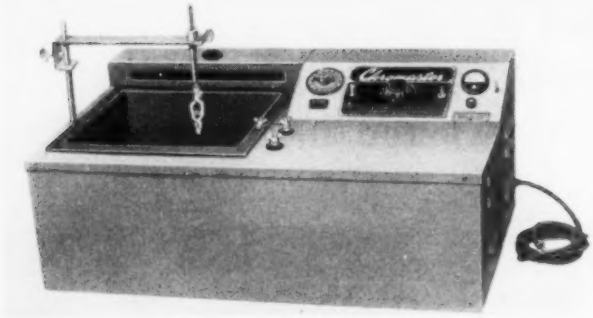
Title_____

Company_____

Business Address_____

City_____ Zone_____ State_____

678

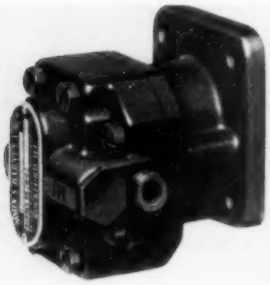


Ward Leonard Hard-Chrome Plate Increases Cutting-Tool Life

The Model A-50 Chromaster can put a hard-chrome plate directly on cutting tools and wear parts. After 3-min plating time, the average life of cutting tools is said to be increased two to ten times.

The unit has capacity for plating metal surfaces totaling 25 sq in. maximum at the recommended current density of two amps per square in. It consists of a built-in selenium-rectifier power supply, rectangular plating tank, and instrument panel. Current control is by means of a continuously adjustable auto transformer. It operates from single-phase 110-120 volts 60-cycle ac.

Ward Leonard Electric Co., Industrial Chrome Div. 108 South St., Mt. Vernon, N. Y.

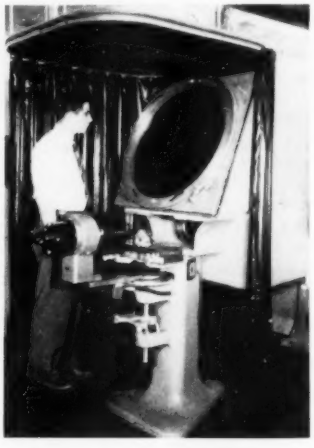


Barnes High-Pressure Pumps

The Model PA-7100-BA is designed to operate intermittently at pressures up to 1850 psi.

Two spur gears rotating inside of a precision-bored housing provide the displacement. As the gears rotate in the housing, a vacuum is created in the intake chamber, thus drawing in fluid from the source; this fluid is carried around the gears in the spaces between the teeth and is forced into the compression chamber under pressure. Four needle bearings are used on the gear shafts. It is being used on hydraulic lifts, lift trucks, power steering, and in fuel-transfer applications.

John S. Barnes Corp., 301 South Water Street, Rockford, Ill.



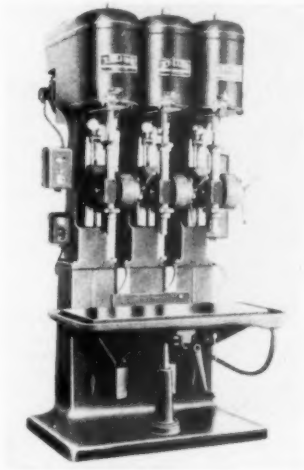
Jones-Lamson Optical Comparator Magnifies 5-Fold to Max of 30 in.

A 5-magnification projection lens with a 6-in. aperture and a 12-in. focal clearance has recently been perfected to facilitate visual inspection with the use of optical comparators.

With this lens the contour of any object which lies within a 6-in. circle can be projected in its entirety onto a 30-in. receiving screen for measurement or direct comparison with extreme accuracy and sharpness of outline.

The large aperture provided by the lens permits direct over-all inspection of a wide variety of relatively large objects. Typical applications include the inspections of cams, templets, air-foil sections, and cutters.

Jones & Lamson Machine Co., Springfield, Vermont.



Drilling and Tapping Machines Have Variable-Speed Drive

The infinitely variable-speed drive allows the operator to select the proper spindle speed for max tool life and greatest production. An indicating dial shows the speed selected when turning a handle. The range is from 200 to 2700 rpm. Additional speeds from 50 to 675 rpm are obtained with back gears. Capacity is $\frac{3}{4}$ in. in steel (1 in. with back gears), $\frac{7}{8}$ in. in cast iron ($1\frac{1}{4}$ in. with back gears).

Known as the 2F, the standard machine is available with 1, 2, 3, 4, 6, or 8 spindles; in pedestal or round column; and with 8- or 15-in. overhang from face of column to center of spindle.

Additional equipment includes semi-automatic power feed that automatically engages as the drill touches the work; a reversing-motor tapper capable of tapping 30 holes per min and reversing at the same depth within $\frac{1}{4}$ turn of the tap; a lead-screw tapper with adjustable stops and interchangeable pickoff gears; and a gusher coolant system.

Edlund Machinery Co., Cortland 1, N. Y.

SUNTAC ENDS LUBRICATION HEADACHE

Keeps Plant in Full Operation and Reduces Oil Consumption 50%

Cold-rolling threads on cold-headed bolts is a tough operation, and a mighty big financial headache, if the thread-roller does not receive proper lubrication.

Such a condition developed in the plant of a well-known manufacturer of screw machine products. Oil ran out of bearings and would not adhere to the guides for the reciprocating die holder. On several occasions the main bearings overheated and seized up. In each instance four days' downtime resulted, costing a large amount for labor and 30 percent in bolt production. Furthermore, the oil loss became so excessive that maintenance crews actually had to put in extra work to keep floors clean and safe.

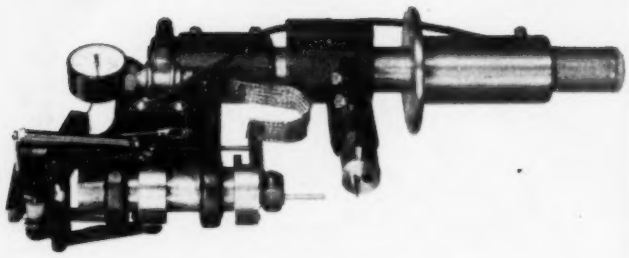
In his search for a solution to the problem, this manufacturer called in a Sun representative, who induced him to try Suntac Oil. In the 18 months which have elapsed, there have been no production losses attributable to inadequate lubrication, downtime has been eliminated, and cleanups have been reduced to a routine minimum. The consumption of oil has been cut in half. Savings on oil and maintenance have amounted to more than $3,000.

Suntac Oils are recommended for general lubrication in all machinery where retention of oil in bearings is a problem. These "Job Proved" products cling to the parts to be lubricated. For further information, call or write your nearest Sun Office.

SUN OIL COMPANY · *Philadelphia 3, Pa.*
In Canada: Sun Oil Company, Ltd.
Toronto and Montreal

SUN PETROLEUM PRODUCTS
"JOB PROVED" IN EVERY INDUSTRY

SUNOCO®



Interchangeable Electrodes Used On Raytheon Welding Head

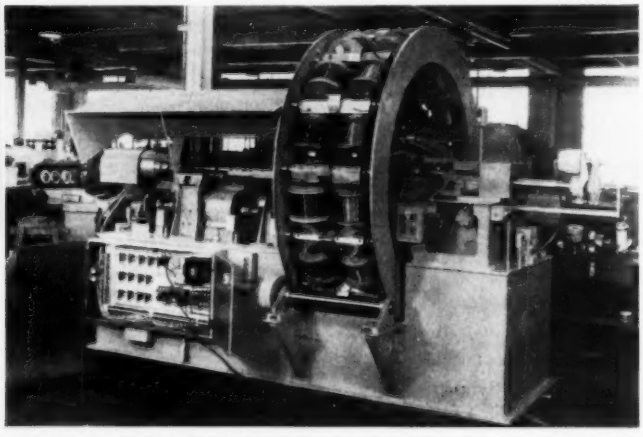
A welding head, manufactured by Raytheon, is said to be extremely flexible in application. It is used for welding dissimilar metals in the assembly of radio and electronic tubes, as well as for the assembly of other small metal parts.

The head (Model I-S, Weldpower) is a bench-mounted press unit with single post mounting. Accurate electrode pressure is made possible through the use of a closed air system having a metal bellows, with instantaneous electrode follow-up achieved by keeping the moving parts of the upper electrode assembly extremely low. This makes possible many welds that can not be executed with high-inertia heads.

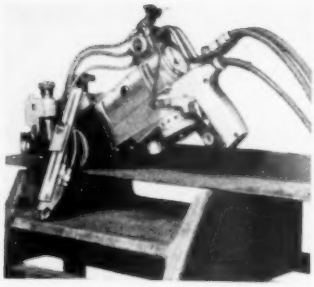
A simple electrode clamp makes electrode changing fast and easy, with either ⅛ or ¼ in. used interchangeably. The lower electrode mounts either horizontally or vertically. The opening between the faces of the upper and lower electrode holders is adjustable from 1 to 4 in., making possible the changing of larger jigs or fixtures without impairing the operational features of the machine.

Extremely small and compact, the welding head is only 3½ in. wide, 9½ in. high, and 8½ deep.

Raytheon Mfg. Co., Waltham 54, Mass.



AUTOMATIC ARMATURE WINDER draws strands of wire from an 84-in. rack holding 28, 12-in.-dia spools weighing 80 lb each. The rack rotates automatically when the spools need replacing. A system of solenoid valves, electrically timed, operate the unit and provide safety measures. Some characteristics of this unusual machine: (1) It automatically loads the armature cores. (2) It winds all 28 coils simultaneously (compared to older units which wind one or two at a time). (3) It is reported to wind the coils with perfect symmetry, permitting air to circulate freely through the generator. 10 C cooler operation. Cleveland Elec. Equip. Co., developed the machine—Lewis built it. — *Lewis Welding and Engineering Corp., Bedford, Ohio*



Flame-Cutting Machine Is Single-Hand Operated

A novel single-hand-operated oxy-acetylene cutting machine made by Kjeellberg-Eberle, Frankfurt am Main, Germany, is now being imported for American distribution.

The machine will cut plates from 5/64 to 2¼ in. thick cleanly and smoothly and is said to be particularly suitable for shape cutting. By simply guiding the machine with one hand a variety of shapes can be cut including small radii and sharp corners. Straight cuts are made automatically with the aid of a standard-angle or U-rail. Circular cuts are also made automatically with a radius rod and a weighted center-point provided with every machine.

A ventilator fan acts as a cooler which forces a stream of cool air through the machine during the cutting process. A built-in tachometer indicates the desired cutting speed. The proper selection of cutting speed, oxygen pressure, torch tips, and the correct distance between tips and work surface, is given in a table attached to the machine.

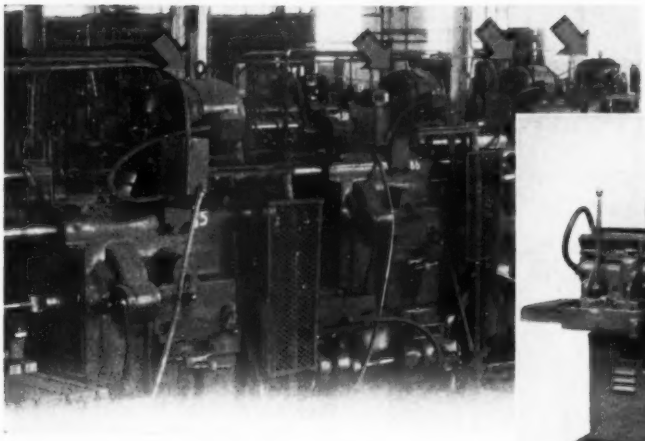
The machine is equipped with a vertically and horizontally adjustable flat-head torch with heating and cutting tips arranged in series. Torch head and valve units are connected by flexible Monel metal tubes.

Weighing less than 19 lb complete with blowpipe, the machine can be powered by either a 110 or 220 v a-c or d-c motor.

R. Caluwaerts Co., Inc., 1 W. 67 St., New York, N. Y.

Driving rivets with hydraulic pressure utilizes a squeezing action rather than the usual hammering of the rivet head. The Riveteer Unit delivers 60,000 lb thrust through the hydraulic ram and will drive ⅝-in. cold rivets. The unit is portable, easy to operate, and the riveting cycle takes but 2½ sec. The operator controls the ram, retraction is automatic.

Manco Mfg. Co., Bradley, Ill.

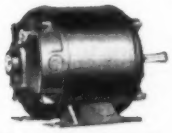


Four Century 5 horsepower squirrel cage motors operate milling machines

Century 5 horsepower motor driving a grinder

Century

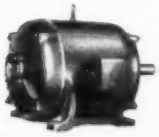
TYPE SC-
SQUIRREL CAGE MOTORS



⅛ to ¾ horsepower

1 to 1½ horsepower

2 to 15 horsepower



20 to 125 horsepower

150 to 400 horsepower

Equipment Producers Select Century Motors

To Give You Long-Life Performance With Least Down-Time

The correct selection of the right combination of motor type, speed, power, torque, frame and mounting keeps Century motors on the job; reduces production headaches.

Team work between your motorized equipment producers and Century motor engineers means that you always get the right motor—selected from Century's wide range of types and kinds, in sizes from ⅛ to 400 horsepower for single or polyphase alternating current and direct current. You can be confident that you get top performance from the fine equipment these motors drive.

Skillful application makes sure that Century motors meet the exacting requirements of the machines they drive. That's your assurance of dependability.

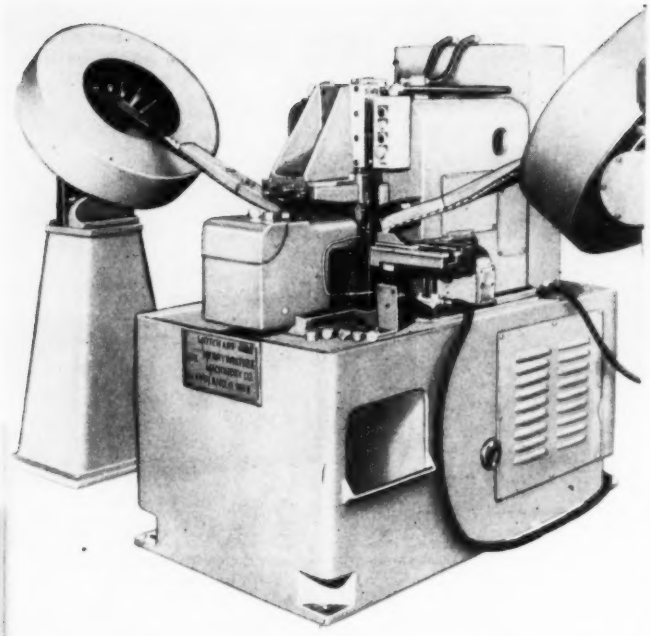
CENTURY ELECTRIC CO. 1806 Pine St., St. Louis 3, Mo.

Offices and Stock Points in Principal Cities

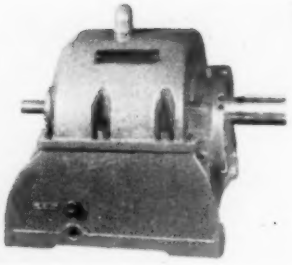
Century Electric Company is celebrating its 50th year in the electrical industry.

CE-690M

Specify Century MOTORS for all your electric power requirements



CAM AUTOMATIC turns the OD and chamfers one end of laminated silicon-steel motor rotors. Varying lengths of any one dia can be handled. All machine functions are mechanically controlled by one main camshaft. Cam-actuated loading mandrels automatically locate in the centerholes of each piece and force the piece against the hardened drive spurs mounted on the face of each spindle, while the magazine slides retract and reload. The toolslide, mounting quick-change tools, rapid advances downward to position and feeds horizontally across the diameter of the work. The main camshaft has its own drive motor, as has each of the two spindles.—*The Motch & Merryweather Machinery Co., 715 Penton Bldg., Cleveland 13, Ohio*



Speed Reducers for Straight-line Drive

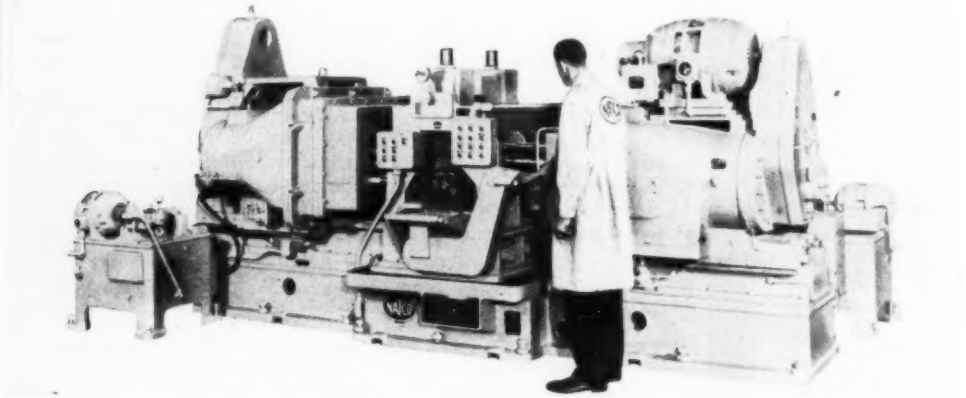
Type DB double-reduction speed reducers in ratings from 1 to 100 hp are available from Westinghouse. They are designed for applications on small- to medium-size drives where the prime mover is coupled or belted to the gear unit.

These double-reduction speed reducers use all-external-type helical gearing, arranged in a horizontal plane. When coupled to an electric motor, a straight-line drive results. Eight unit sizes are available; twelve standard gear ratios range from 6.25 to 58.3:1.

Other features include: accurately hobbed single-helical gearing, taper hardened by the Westinghouse B-T process; split-construction cast-iron case; positive splash-lubrication system; antifriction bearings.

The units are manufactured in accordance with recommended practices of the AGMA.

Westinghouse Electric Corp., Box 2099, Pittsburgh, Pa.



TWO-WAY, HORIZONTAL TAPPING MACHINE taps 47 holes in 20 automotive cylinder blocks per hr. All operations are automatic as follows: left-hand head: 11 holes to ¾-in. pipe tap; 4 holes to ⅛-in. pipe tap; 2 holes to 5/16- in. pipe tap; 5 holes to ⅜-in.—16 tap; 1 hole to ⅜-in. NPT. Right-hand head: 13 holes to 7/16-in.—14 tap; 6 holes to ¾-in. pipe tap; 4 holes to ½-in.—13 taps; 1 hole to ⅛-in. pipe tap. — *National Automatic Tool Co., Richmond, Ind.*

The World
IS HYSTER'S WORK YARD

The sun never sets on Hyster Sales and Service. In the important industrial centers of the United States and in 58 foreign countries, Hyster dealers maintain service and parts stations on Hyster Fork-type Lift Trucks, Straddle Trucks, Karry Kranes and Hyster *Salsbury* Turret Trucks.

This world-wide organization sells the most complete line of Industrial Trucks and Attachments on the market. Equally important, they have skilled service mechanics and adequate parts stocks to keep your lift trucks running better at lower cost.

HYSTER® COMPANY

THREE FACTORIES

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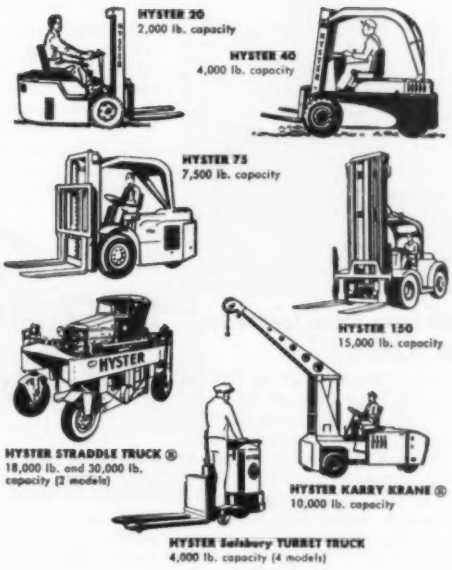
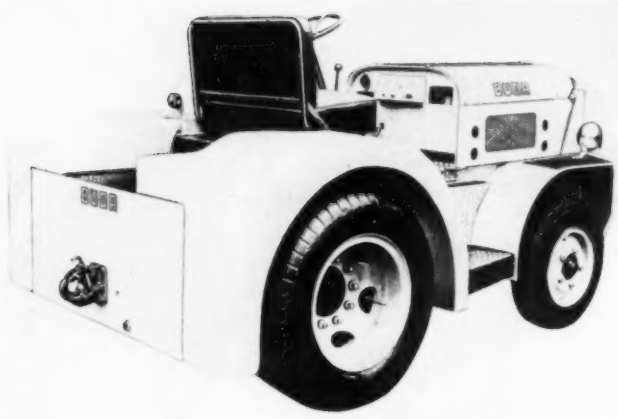
1802-14 North Adams St. . . . . Peoria 1, Illinois
1010-14 Meyers St. . . . . Danville, Illinois





Tractor with Torque Converter Has Drawbar Pull of 6 Tons

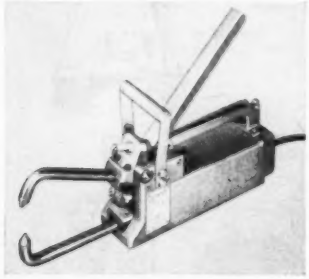
A tractor, designed to handle all airline, railroad, industrial, and military tough pushing and pulling jobs up to 12,000 drawbar pull, is now being manufactured by The Buda Company.

The model HA-120, is equipped with a single stage, closed-circuit torque converter which eliminates shock and undue strain and smoothly applies maximum power even when starting under full load conditions.

The tractor is powered with a 6-cylinder, 230-cu-in.-displacement gasoline engine. As optional equipment this tractor is available with a diesel engine of the same large displacement and with interchangeable mountings.

Other features include: 4-wheel hydraulic brakes, special positive heavy-duty transmission having 4 forward speeds and one reverse, 17-gallon Protectoseal fuel tank, adjustable seat, and dual pneumatic drive tires.

The Buda Co., Harvey, Ill.



Toggle Lever Locks Spotwelder Tongs to Work

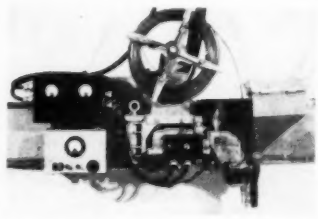
Spotwelder has a range up to 3/16 in. combined thickness on mild and stainless steel or two pieces of 16-ga. galvanized metal. This exceeds by 50% the ⅛-in. capacity of the standard 110- and 220-v models.

All models are operated with a toggle-action lever that locks the tongs on the work while the weld is being made.

A variety of interchangeable tongs, with replaceable tips, adapt the welder to any job, especially in "hard-to-get-at" places. The unit operates on 220 v, single-phase ac.

The heavy-duty model weighs 31 lb, the two standard models 25 lb each. Prices are $138 and $98.

National Cylinder Gas Co., 840 N. Michigan Ave., Chicago 11, Ill.



Controlled Speed Rates Feature of Linde Welder

Uniform welding of straight-line seams in light to heavy plate can be done at high speeds with the Linde UE-48 welding machine designed for use as a permanent production installation.

The machine consists of a side beam carriage, a UE welding head, a small rod reel, a Unionmelt feed hopper, and controls. The equipment is mounted on the steel frame of the carriage, which rides a cold-rolled steel track.

The welding current, carriage speed, voltage, and material flow can be pre-set into the control mechanism before the machine is put into operation. An electronic governor controls the speed of the carriage, permitting a stepless speed range from 3 to 200 ipm. The rate of speed can be pre-set by a meter and can also be changed while the carriage is in motion.

The machine, when set for a particular operation, requires only an operator to load and unload the welding jig, the automatic operation assuring identical welds.

A wide variety of work can be handled, metal from 16-gage to 1½ in. thick can be welded with a single pass. The head can be positioned at right angles or parallel to the track and is adjustable to make any type of butt or fillet weld.

Linde Air Products Co., A Div. of Union Carbide & Carbon Corp., New York 17, N. Y.

Foot-Operated Air Valve Boosts Production

Foot-operated valves permit hammers, shears, presses, hopper gates, furnace doors, and all other types of air-operated machinery and equipment to be fully controlled by foot pressure on a pedal.

The valving mechanism body and the push-pull rods are made of stainless steel. Brass sleeves and self-sealing U-shaped packers are used.

The valve is available in sizes from ⅜ to 1 in., and with either a 3- or 4-way regular action. There is a neutral position on both types. It is supplied with 1 or 2 pedals, for air to 150 psi and to 150 F.

C. B. Hunt & Son, Inc., Salem, Ohio.

HELLER

NUCUT WAVY TEETH FILE

GOOD TOOLS SINCE 1836

Only a NUCUT gives you "doubling-in-brass" filing

Cash in on the file with the WHITE TANG

1. CUTTING ACTION
2. SMOOTHING ACTION
} *At every stroke*

FILING with a NUCUT is like using two files in one. With each and every stroke, the coarse teeth slice off metal fast, true. At the same time the fine teeth finish the surface *smooth*. No skidding or waste motion, no clogging that requires frequent cleaning, no scratches to remove. In short—better, faster, easier filing.

You can tell a NUCUT both by the WHITE TANG—and from the wavy appearance of the patented teeth when you hold the file at an angle. *Your distributor* will gladly tell you the right sizes, shapes and cuts to reduce your filing costs to a minimum.

HELLER BROTHERS COMPANY

America's Oldest File Manufacturer

Newcomerstown, Ohio

How to protect files

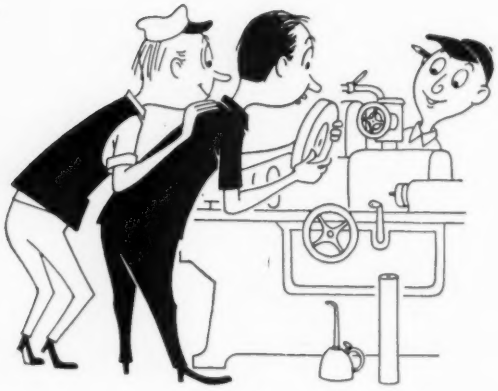
A file is a cutting tool. To give you its best service, it must be carefully handled and safely stored.

WRONG: Throwing files together or with other tools results in dull or broken teeth.

RIGHT: Keep files separated. You can do this easily by hanging files in racks . . . or placing them in wood partitions. Either way affords good protection.

CONTACT YOUR INDUSTRIAL DISTRIBUTOR for our FULL LINE of American Pattern, Swiss Pattern, Milled Curved-Tooth and Rotary Files, Rasps, Machinists' and Carpenters' Hammers, Blacksmiths' and Farriers' Tools, Bricklayers' and Plasterers' Trowels, Craftmaster Scrapers, Chisels, Punches, Masterenches and other quality tools.

There's something worthwhile going on here!



SIMONDS ABRASIVE CO.

Grinding Wheels

A Simonds Abrasive Company grinding wheel . . . that's what's going on. It's going on the business end of the grinding machine to end a troublesome bottleneck. Like all Simonds wheels it can be depended on to give top results on the job. It's part of a complete line containing everything you need in grinding wheels, mounted wheels and points, segments and abrasive grain . . . efficient production tools, accurately specified and made under complete quality control by Simonds Abrasive Company, a major manufacturer of grinding wheels for almost 60 years. Write for free data book and name of your Simonds distributor.

SIMONDS ABRASIVE CO., PHILADELPHIA 37, PA. BRANCH WAREHOUSES: CHICAGO, DETROIT, BOSTON
DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

ROUND TABLE Discussion

HEAD BEATS HANDS

HEADS can always beat hands. This is shown, every day, in many ways and under many different kinds of circumstances.

As regards Al and Ed and their discussion, it may be true that Laziazell will strive to make his work easier and so save his efforts and the company's time. Incidentally, Al may work out some gadget or method which will be to the advantage of himself and his employers alike.

A few years ago, a small woodworking plant originally employed eight men. The owner was an ingenious, good-natured young fellow.

Men were scarce, so, as soon as a man left, the owner took over the operation of the machine which the man had been operating, and so he began to run two machines.

This continued, and as fast as men left, he made a mechanism for each machine until he was running eight machines by his own efforts, which meant all of the machines in his shop were under his direct observation.

How did he do this? He built cheap home-made magazine feeds for all machines, so at the end of six months, he was the whole operating force except for one man working on the floor below running a swing cutoff saw.

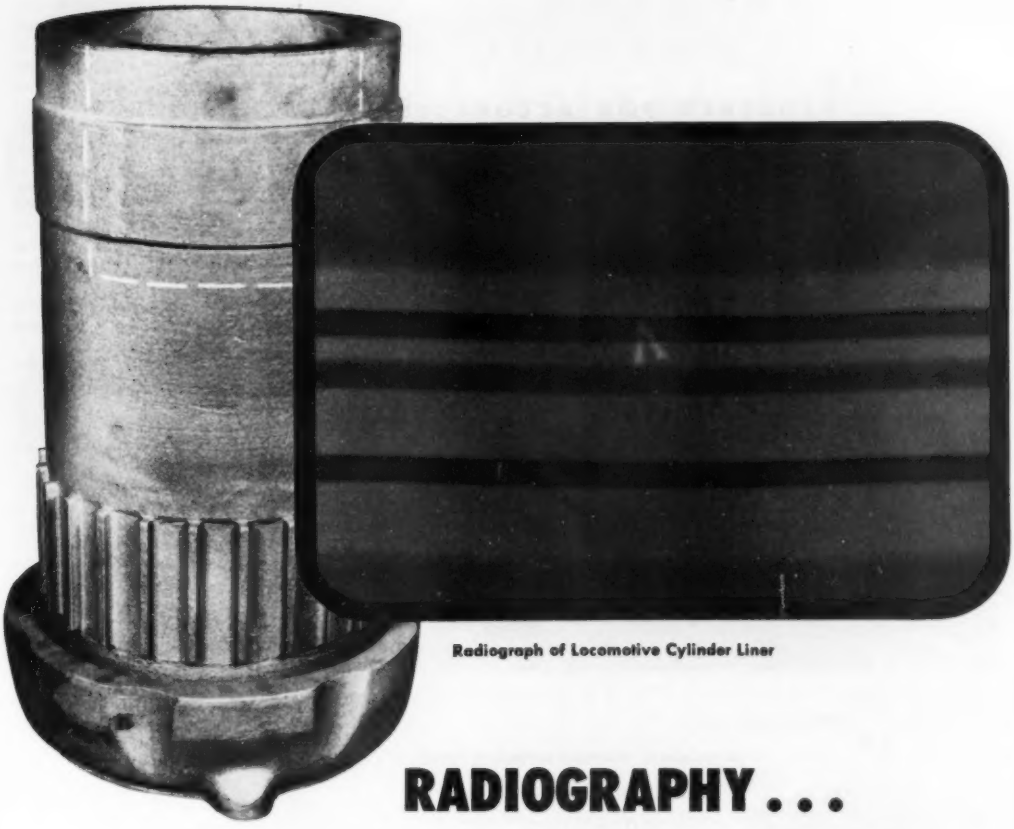
It was a queer and pleasing sight to see him standing in the middle of the floor. He would pull a rope here, push a stick there, step on a treadle at his left, then turn around and bunt a bunch of raw material onto a plank so it would pass a bandsaw. Proving that ingenuity can overcome many obstacles.

There are other features in regard to designing and building machinery. It must be built at the lowest cost consistent with honest quality; it must be far stronger than the requirements; it must wear long and well; it must be convenient to operate; and be able to do the job.

In a large auto and parts manufacturing plant, there is a huge machine which, in order to produce, must be tended by five men placed at different stations, to observe the operations.

No man does any lifting of heavy parts but each must be at his post to check upon the condition of the tools.

As the machine, set in place, cost



Radiograph of Locomotive Cylinder Liner

RADIOGRAPHY . . .
one factor in Diesel dependability

DIESEL LOCOMOTIVES take millions of miles of service in their stride. They've won the acclaim of roads and riders alike for their smooth speed and dependability.

Radiography does its share in this dependability. Such parts as the cylinder liner shown above are checked for subsurface faults that could cause breakdowns if undetected—or, if discovered during machining, cost valuable time.

More and more foundries make it a practice to radiograph their castings. It lets them know they release only high-quality castings. It frequently points the way to improved casting methods and increased yield in production runs.

You can find out how Radiography can improve operations in your plant by talking it over with an x-ray dealer. And you can send to us for a free copy of "Radiography as a Foundry Tool."

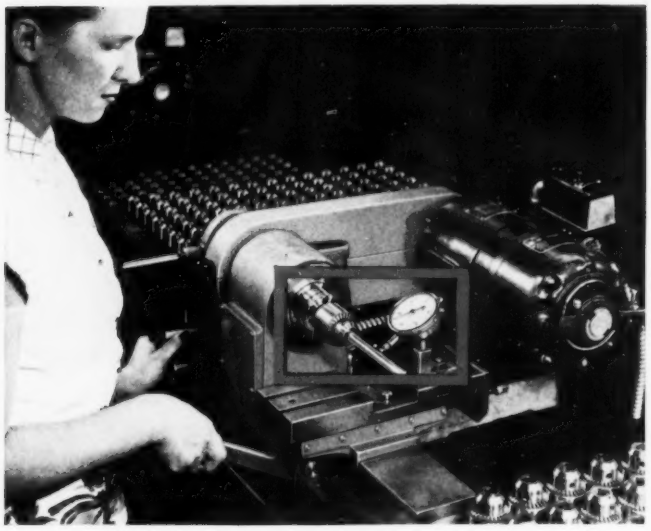
EASTMAN KODAK COMPANY
X-ray Division • Rochester 4, N. Y.

Radiography . . .
another important function of photography

Kodak
TRADE-MARK

SUPREME
BRAND CHUCKS

CHECKED FOR ACCURACY!



no guesswork . . .

precision manufacturing and finest materials assure
DEPENDABILITY!

Sold Through Distributors

Every Supreme brand chuck is mechanically checked for accuracy . . . there is no guesswork in this inspection that assures you of a precision product. It is just part of the careful manufacturing that enables us to present this new Supreme chuck as both dependable and accurate. The best way to appreciate it is to try it . . . ask for Supreme brand chucks the next time you order.

SUPREME BRAND CHUCKS

Supreme Products, Inc., 2222 South Calumet Avenue, Chicago, Illinois

THE CHUCK THAT LIVES UP TO ITS NAME . . . SUPREME

nearly $50,000, you may think it was expensive, and so it was, but it does one-hundred eighty-nine operations and does them faster than single- or one-operation machines, to say nothing of the extra handling from machine to machine that would be necessary with smaller machines. This is another case where head beat hands.

The company figures that the machining cost per piece has been reduced until it is twelve per cent of the amount required to do all of the operations on single-operation machines.

In a thousand other operations and in as many plants, it has been proved that "head beats hands."

F. H. Stebbins
Worcester, N. Y.

•

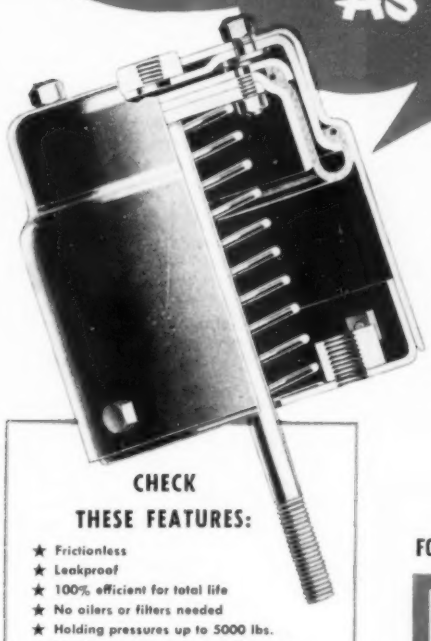
I HAVE HEARD the expression many times: "When you want to find the easiest way to do a job, give it to a lazy man", but in my experience the discovery of the easiest way to do a job was not limited to the lazy worker. On the contrary, labor and cost-saving ideas have come from the worker who has had the ambition and energy to challenge each detail of his job for easier and cheaper operation. He was the type of worker who knew that he as well as the company would benefit from improvements. In my experience, it has been the wide-awake, energetic worker; open-minded and inquiring, and aided by an efficient and considerate foreman, who questioned and analyzed existing methods for doing the job, and tried out new ideas.

Analysis of suggestion systems reveals that cost- and labor-saving ideas come from all types of workers, most of them of the ambitious and wide-awake category. Where management is cooperative and good conditions prevail in the shop, and especially if the foreman is understanding and is a good leader, there is nothing to stand in the way of enlisting the imaginations of the men on the job. Too often a top-level idea has everything but the homely virtue of being practical. Perhaps the executive's more important function should be the sifter, rather than sole originator. In any case, it's the ideas that count, and management's concern should be how to get them. Where management furnishes the incentive to the worker, and good shop conditions prevail, most men will endeavor to improve the product through operating economies because they know it will benefit themselves in the long run.

Unit cost of making the product

ON OLD OR NEW MACHINE TOOL OPERATIONS—

YOU CAN STEP UP YOUR PRODUCTION AS MUCH AS 30%



....WITH THIS SIMPLE, RUGGED, LOW COST AIR CYLINDER!

The pressure for production is on! Manufacturers everywhere find it increasingly difficult to keep pace with the demands of the day. But there is a way—a brand new way requiring no addition to manpower, no addition to plant facilities. The answer? Remarkable Bendix-Westinghouse Robotair Industrial Controls. With their wide range of applications, Robotair controls offer you amazing improvements in production speed and economy through increased productivity of man and machine at *unbelievably low initial cost*. Robotair units are available as original equipment for machinery manufacturers or for easy installation on shop equipment.

Send today for an informative booklet and find out how you can cut costs, speed production with Robotair! Address Bendix-Westinghouse Automotive Air Brake Co., Dept. C, Elyria, Ohio.

CHECK THESE FEATURES:

- ★ Frictionless
- ★ Leakproof
- ★ 100% efficient for total life
- ★ No oilers or filters needed
- ★ Holding pressures up to 5000 lbs.
- ★ Diaphragm has rolling action and exceptionally long life
- ★ Made from high grade steel stamping—all metal parts cadmium plated
- ★ Chrome Molybdenum Steel Push Rod heat-treated for maximum toughness
- ★ Easily installed

FOR HOLDING, CLAMPING, BENDING, SWEDGING, STAKING, RIVETING

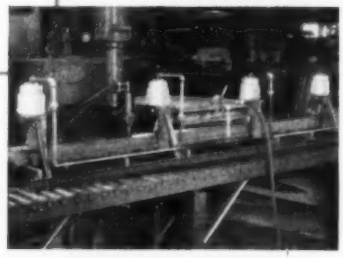
ROBOTAIR

THE INDUSTRIAL AIR CONTROL OF A THOUSAND USES

BENDIX-WESTINGHOUSE ROBOTAIR

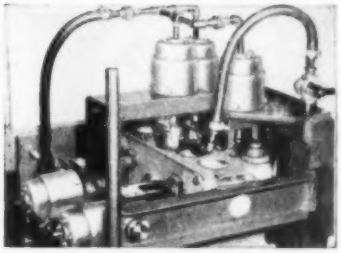
Bendix-Westinghouse

Bendix-Westinghouse Automotive Air Brake Company Elyria, Ohio



REDUCES OPERATOR FATIGUE

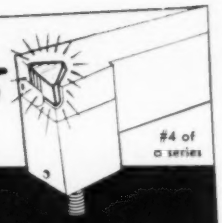
Four Rotochambers installed on the fixture in this spot welding operation replaced cumbersome hand clamps, saving time, greatly reducing operator fatigue.



SPEEDS INSPECTION METHODS

Installation of Rotochambers on this water test operation for engine castings eliminated hand operated fixtures, thereby speeding inspection and cutting costs.

Tool Saving Tips



#4 of a series

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Gives information on proper selection, application, and maintenance. Many useful tables, typical job layouts, etc. Vest pocket size.

USE KENNAMETAL SERVICE AIDS

CLAMPED TOOL MANUAL

Describes and illustrates how you can make a wide variety of special purpose mechanically-held tools in your own shop. Letter size.

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Illustrates and describes operation and maintenance of various inserted-blade cutters. Contains unique "trouble-shooting" section. Vest pocket size.

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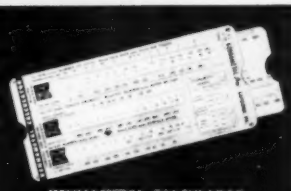
Contain specific data on tooling and methods used in hundreds of shops to save tools, floor-to-floor time, and grinding expense. Letter size.



KENNAMETAL CALCULATOR

Automatically correlates various factors to give proper speed and feed rates for turning, boring, milling. Eliminates guesswork and calculating. Vest pocket size.

FIELD SERVICE

Our field engineers offer you the greatest collection of carbide tooling "know how" that is available through any one source.

All these service aids are available to you to help you get more work from fewer carbide tools. Ask your nearest Kennametal representative about them, or write to us.

KENNAMETAL® Inc., Latrobe, Pa.

MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES AND CUTTING TOOLS THAT INCREASE PRODUCTIVITY

will drop where the foreman invites critical suggestions from the workers. Many potential labor-saving devices, short-cuts and improvements in mechanical processes for economical operation have been lost because the progenitors of such devices did not have the opportunity to present their ideas where good use could be made of them. No worker has an exclusive monopoly on ideas for getting a job out faster or better.

There is no better way to learn things than to get the other man's point of view and ideas. Money-saving ideas and possible solutions to problems can only see the light if proper encouragement is given the suggestors. The foreman who encourages suggestions on the work may see a lot of screwy ideas coming through, but the freedom of thought permitted amply repays for the idea. Improvement in methods, procedures and processes have developed from ideas submitted directly by the men. It will be found that the men are full of ideas. There is a general "idea fertility" possessed by the workmen. Any means that will stimulate thinking along the line of product-betterment naturally deserves the active support of management.

Not the least waste in modern industry is the waste of ideas from the working force. This results from improper planning by the foreman. Proper planning insures that the foreman will be in daily contact with the minds of his workers and their jobs so that he can establish the personal relations that lead to a free flow of ideas from workers about their work, methods, tools, machinery, and materials. From them he must get information in the way of facts, criticisms, and suggestions that will lead to better use of production facilities.

Harry Kaufman
Philadelphia, Pa.

•

WHO PAYS THE PIPER

WHEN A WORKER displays unusual aggressiveness in getting his work done in less time, even though selfishness is at the bottom of it, he certainly should be rewarded some way or another. We have so many perfunctory workers within our midst that it is indeed a pleasure to come upon one who shows an interest in improving production methods. This may be dog-eat-dog, free enterprise, or cat-throat competition if you like, but the fact remains that the advantage rests upon superiority.

Increase in production should be

For BETTER CASTINGS

from First Design to Final Check . . .

Call on ECLIPSE-PIONEER *Foundries*

ALL Aluminum and Magnesium Alloys
Including the recently developed
Cerium and Zirconium Magnesium Alloys

When you order castings from the Eclipse-Pioneer Division Foundries, you *know* they will be right. Your confidence is justified at *every step* in their manufacture, from first design to final check, for each man is an expert in his field and each operation is backed by more than twenty years' experience. But, this craftsmanship is only part of the picture. As a further guarantee of quality, the Eclipse-Pioneer Foundries use the most modern machines, techniques and testing devices obtainable . . . the entire production line is conveyorized to assure rapid and economical service on all orders. Take advantage of these extras. If you plan to use aluminum and magnesium castings, make it a point to consult Eclipse-Pioneer. Meanwhile, send for Eclipse-Pioneer's "Book of Facts".

PLEASE SEND ME THE ECLIPSE-PIONEER "*BOOK OF FACTS*" ON MAGNESIUM, ALUMINUM AND BRONZE CASTINGS. AM

NAME _____ TITLE _____

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CITY _____ ZONE _____ STATE _____

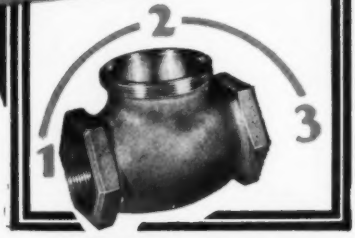
ECLIPSE-PIONEER DIVISION FOUNDRIES
BENDIX AVIATION CORPORATION
TETERBORO, N. J.

Bendix AVIATION CORPORATION

AND PRECISION (±.005")

PLASTER MOLD CASTINGS

ALL ENDS OF PARTS
Completely Finished
"1·2·3"
ON THE
GOSS *and* DeLEEUW
Automatic Chucking Machine
in 1 SET-UP

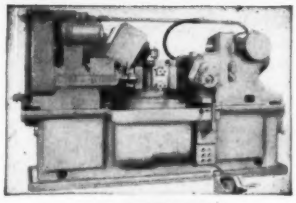


This recent Goss & DeLeeuw development has already received universal acclaim as an outstanding development.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.

Easy, fast change-over from job to job makes this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence — a method exclusive with Goss & DeLeeuw and offered on this machine.



Illustrated literature available promptly on request. Send samples of your work for time and cost estimates.

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dependent upon added work imposed on machines, not the wrecking of an operator through overwork. This brings up the question as to who should receive the benefits derived from the improvement in production. Granted that the owner of the machine is entitled to his share of the gain caused by the use of a better cutting tool, for instance, the question arises as to how much of the saving he should receive. We mustn't let annoying distractions interfere with our chief purpose, however, in arriving at a just distribution of benefits.

The question of what percentage of gain should go to the employer, and what to the ingenious employee, is something that should be given serious consideration prior to any radical changes in production procedure. It should be understood that rates established on any job, set to conform to conditions at the time, would be changed when justifiable. An introduction of a new cutting element certainly is a cause for rate adjustment even though the idea was conceived in the mind of an operator. I think the best way to handle this would be to reward the operator with a worthy check for bringing such an improvement to light, with the understanding that the introduction of the new tool necessitated a revision of the piece rate.

John Homewood,
Ontario, Calif.

•

ALTHOUGH an employee has enough initiative and ambition to devise a faster way to do his job, there is no fundamental reason, to my way of thinking, that entitles him to the additional income accruing to the company through the use of this new method. What he is entitled to is a bonus based on the benefits to the company derived from his use of the new tool or method. It therefore seems justifiable that the worker is only entitled to a reward for being above-average and for his extra efforts, through the form of a bonus based on a set-percentage of increased production.

It is true that the new tool was used on a company machine, and the lathe hand could not have had the opportunity to use the carbide bit if the company had not made the larger investment that provided the machine. So there is no justification for splitting the gain due to the use of the new tool. If the owner put in a new, faster machine he would not be obligated to give the lathe hand increased compensation due to increased production. You cannot get around the fact that the man

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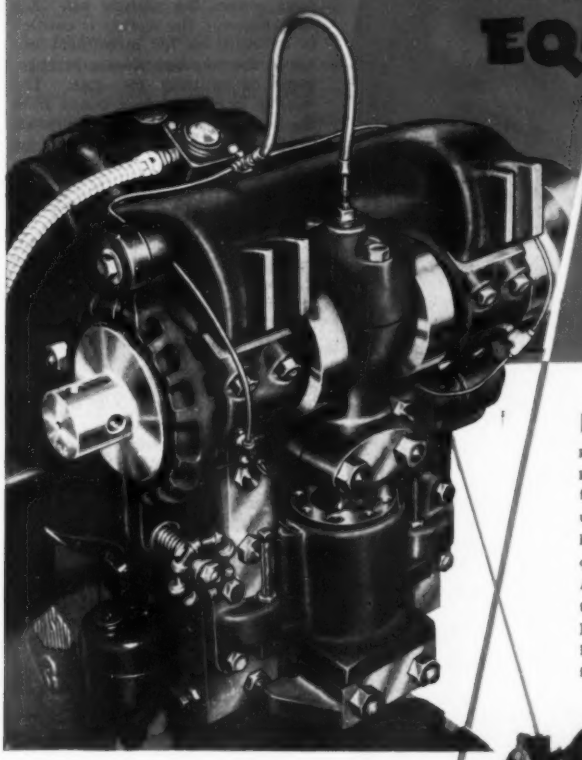

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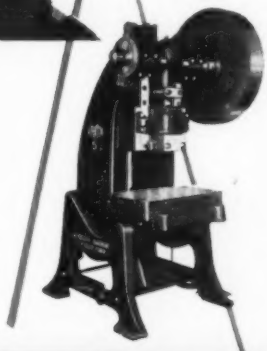

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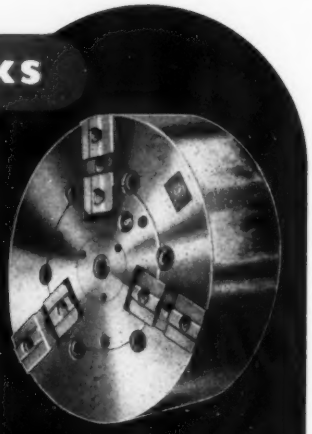

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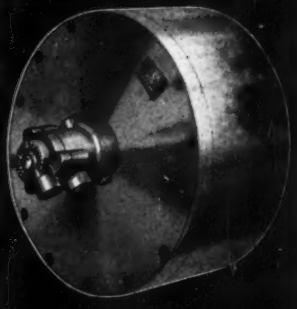

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It all boils down to the fact that the worker had the foresight and initiative to go out and buy the new tool himself after the foreman turned down his request to have the company obtain the carbide bit. For this endeavor, the worker is entitled to a return on his investment but not in the unproportionate arrangement of splitting the gain. The worker is entitled to a bonus from the owner for saving him overhead. Certainly the owner deserves the income in a case like this. The worker deserves some recognition for his superior effort, and a bonus seems the equitable solution.

In this case, the bonus for increased production through use of the worker's own tool could be made in a lump sum when the results of the operation could be determined accurately. The amount of the bonus could be made as a percentage based on individual earnings. The bonus payment idea would serve to stimulate other workers to suggest improvements or new devices for increasing production. A bonus plan secures employee co-operation, and encourages individual initiative. It provides an incentive both for greater output and for increased earnings. Many companies have desired to find an incentive plan that did not pay a bonus purely on physical volume. Quality should not be sacrificed for quantity. However, where a bonus system is in effect for extra effort and for adopted suggestions, the employees will realize that higher earnings will stem from greater output and lower operating costs through their own efforts.

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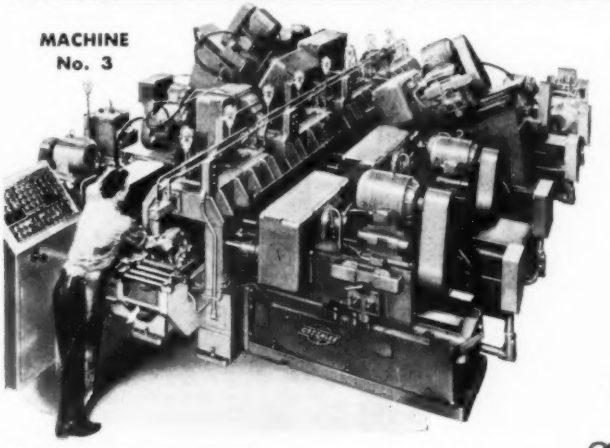

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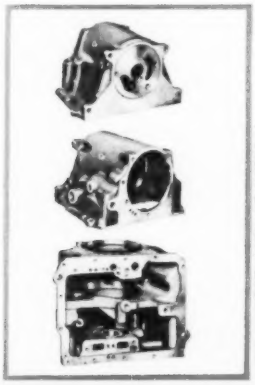

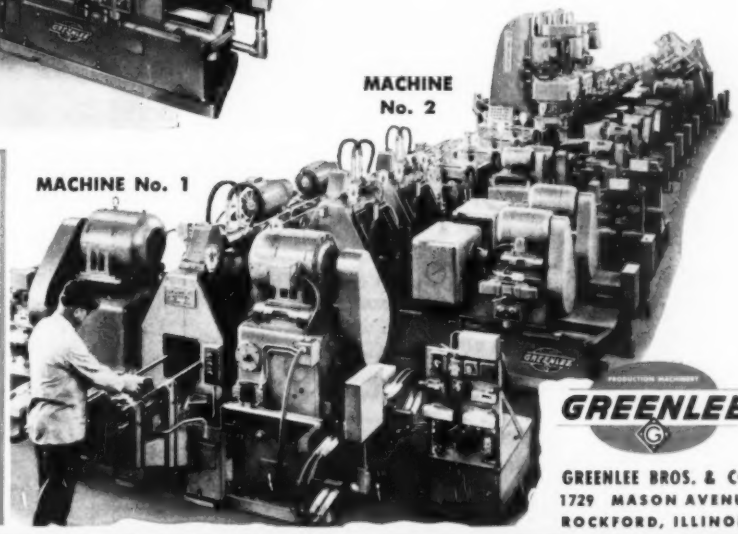

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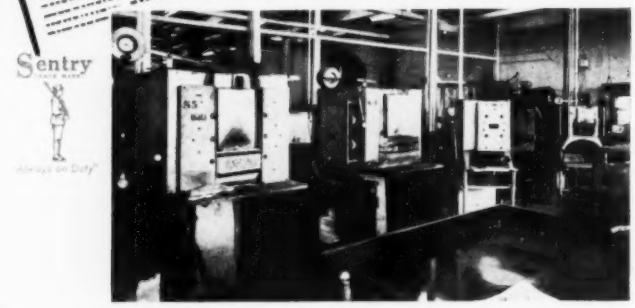

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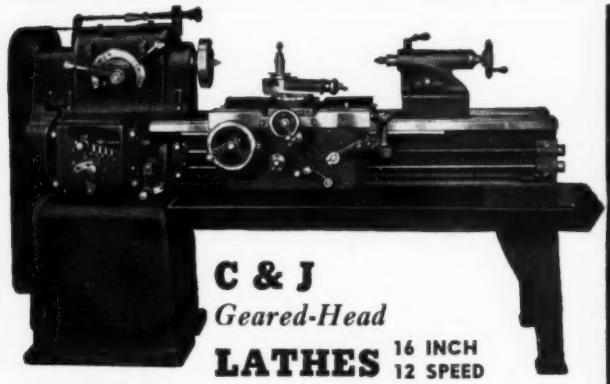

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Of course every worker must come up to some standard. Every foreman has some rule-of-thumb method of judging an employee's output. But many of these methods are haphazard. The more carefully a department is run, the more carefully must employees' production be measured, compared, and recorded. Every worker needs and appreciates some form of production yardstick by which he may progress, compare his efficiency with another worker, or be rewarded for extra effort. A bonus system for individual workers will induce them to devise shortcuts, new methods that will be to their gain as well as to the company. The advantage of the bonus incentive is that it focuses interest on doing well some definite task, thus making the employee feel that he is really sharing profits which he personally has created. It is popular with both employees and employer because it provides an incentive for extra work, and stimulates a highly desirable relationship between management and workers. There are many variations of the bonus plan. They can be based on quota of production, quota of savings, or quota of departmental profits.

In my opinion, there is no question as to who deserves the income in a case like this. The owner, as the investor, is entitled to the income from operation of his enterprise. But the worker should be rewarded with a bonus if his initiative and extra efforts result in exceptional returns to the payer.

Harry Kaufman
Philadelphia, Pa.

•

THIS CASE bristles with difficulties. There are sound accounting reasons behind Ed's insistence on the owner's rights in the matter of running costs; there are also sound recognition rights in Al's "play the game" plea on the man's behalf. If, as Al indicates, the plant was somewhat behind the times, we can reasonably assume that the lathe was neither designed nor built to stand up to the speeds and stresses associated with carbide cutting, even employing a positive-rake grind. If the ambitious lathe operator was taking anything like full value from his carbide tip, the not-so-young lathe must, indeed, have been taking very severe punishment, and it is reasonable to suppose that, if constantly tooled with carbides, the maintenance expense graph for that particular machine would show a steep and sudden rise.

In fairness to the owner, the excess in running costs ought to come

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9-P15

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out of the extra money earned by the enterprising operator. The answer to the question, "Who deserves the income?" is, to my mind, that, out of the operator's increased earnings from the use of a carbide tip, the owner should be reimbursed for abnormal wear and tear of equipment not designed for the use of such cutting tools, minus any gain from reduced overheads as a result of increased production. The owner should also pay for the tip which would then become the property of the company. Without going in for splitting hairs, the foregoing should cover both claims. It is a mistake, when an employee shows genuine initiative, for the owner to squeeze the orange till the pips squeak.

The writer was quite intrigued when he read the article "Who Deserves the Income?" as, during World War 2 he had a similar, if less complex, case to deal with. In this case the lathe operator was working a modern machine designed and built for using carbide tools, engaged on machining manganese-steel castings. A price had been fixed for the job, using a well-known British make of carbide, and the operator concerned was a high-grade machinist with a passion for speed and a lofty contempt for anything which savored of rule-of-thumb. There was a considerable run of this work and this operator set the pace with earnings 50% above time rate. One week his earnings shot up to 85% above time rate and remained at that figure while the others stood around the 40% mark normal for them.

The writer knew this operator well, knew him for the speed mer-

"Somebody must have asked that new tool crib guy for taps again!"

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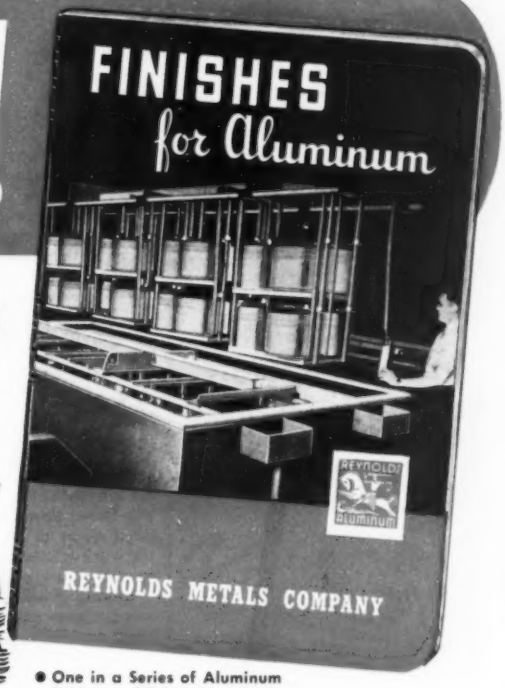

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chant he was but that did not seem to account for the abnormal increase in his production figures. A frank talk with the man revealed the fact that he had gotten hold of a Kennametal carbide tip of a grade specially suitable for machining manganese steel and was making the most of it. It was almost a certainty that the operator never bought the tip; there was a strong suspicion that some other company was one tip short. But discreet inquiry failed to unearth any works in the district using Kennametal.

The company makes a point of recognizing initiative in whatever quarter it is found. Because there were no complications in the matter of overworking unsuitable plant equipment, and because the operator had made no claim for a share of money saved on overhead, they decided to let the man have his increased earnings as recognition of his interest and enterprise. They also purchased Kennametal tips and supplied them to all the operators on the work concerned so that all shared in the higher earnings.

Having reached that stage, they were quite entitled, according to their agreement with the trade unions, to re-price the job in virtue of having introduced improved methods and facilities in the form of a more expensive and more suitable cutting tool. In the circumstances and in order to foster the spirit of adventure in enterprising employees, they decided to waive their right, and experience proved that to be a wise decision. Production figures on the job continued to stand well above those of the pre-Kennametal era but the first startlingly high increases were not maintained. Inquiry revealed that this was apparently due, in part, to mental and physical fatigue and partly to a varying performance of the tips when more were put to work in the hands of different and perhaps less-skilled operators.

C. D. Mackinnon
Lanarkshire, Scotland

•

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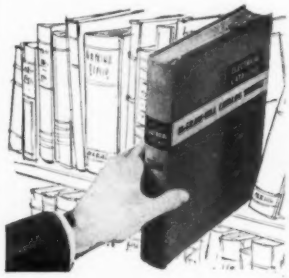

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dividends until after the youngster has taken hold. At its best, when the learner is of that rare make-up so seldom seen, ambitious, conscientious, and eager to promote his own welfare by outside effort—it is a tough pull to make him show that he is worth the effort. Business as a rule thrives on selfishness or it would soon go to the wall; however, it must give in order to get, eventually.

Some compensate for cost of training by having the apprentices spend some of their time in repetitive production. This practice can easily be abused to the detriment of the learner and to the goal strived for by the employer. It must be borne in mind that the training of apprentices should be shared by all types of industry. It isn't fair for one plant to stand the expense of training while others stand by ready to absorb the finished product even though they have not contributed a cent toward maintaining sufficient skilled help. We have the narrow-minded employer who cannot see any farther than his own nose. He takes the attitude, "What's the use of me spending my money to train a kid when the big plants will foot the bill?" In any system, whether the shop has a half-dozen men or half a hundred, there should be a progressive course through which a boy can advance so as to secure the maximum amount of learning of the necessary fundamentals.

If enough effort is spent in making the proper selection of candidates for apprenticeship, they will in a very short while make their positive value known. Naturally the youngsters are going to spoil a certain amount of work but it must be kept in mind that they are learning. What man hasn't learned by making a mistake? In order to keep down these losses there should be supervision. To kill two birds with one stone, why not make use of the old-timer to advise the young? Let him work in conjunction with the foreman so that the proper jobs will be done wherein the necessary experience will be obtained.

Hit-and-miss methods result in loss of time and effort, and the time spent in planning will reap dividends in the long run. At the turn of the century it was my privilege to enter a shop to learn what I could with what they had to give. There were three of us taken in at the same time and jobs were practically thrown at us with very little accompanying instruction. My old dad would do what he could to put me wise to necessary pointers after we

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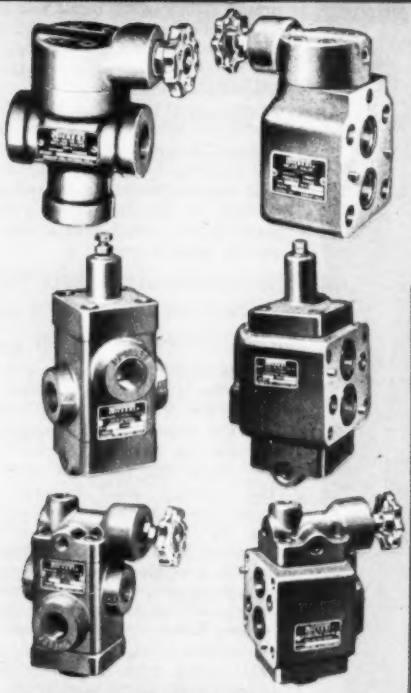
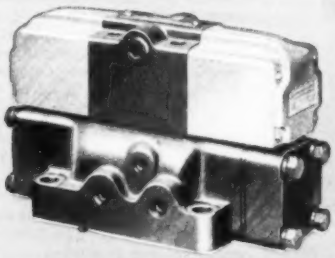
VICKERS PRESSURE CONTROL and DIRECTIONAL CONTROL VALVES



Vickers maximum pressure (relief) valves, pressure reducing valves, and sequence valves are constructed to limit maximum pressure adjustments within nominal working pressure range. Wires and seals can be used after final adjustment for locking.



Vickers pilot operated solenoid controlled, 2 and 3 position—4 connection type valves have oil- and water-tight solenoid enclosures and individual solenoid leads with terminals.

Give you the advantages

of J.I.C. Industrial Hydraulics Standards

The "Joint Industry Conference Hydraulics Standards for Industrial Equipment" have definite benefits for both the user and builder of machine tools and many other kinds of equipment. As these standards are directed toward assuring uninterrupted production of the machine, safety of personnel and longer equipment life (all without stifling hydraulic development), Vickers are participating in the J.I.C. program.

Shown at the left are representative Vickers Valves that comply with J.I.C. Standards. These valves embody proven design and construction features that provide dependability, greater accessibility for maintenance, simplification of piping and reduced installation costs. For further information ask for Catalog 5000.

VICKERS
Incorporated
DIVISION OF THE SPERRY CORPORATION

see our CATALOG in SWEET'S FILE for PRODUCT DESIGNERS

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

3558

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took on our supper. "Well, Jack," he would say as I came in from work, "what'd you learn today?" One evening I arrived home with a heavily bandaged hand. I had to talk myself out of a bad situation as my parent was a sticker for safety-first. I told him that the boss had given me a bronze bushing to make and in reaming out the hole I committed the unforgivable sin of holding on to the tail of the dog without the proper support. The result was that I very nearly lost my thumb when the reamer grabbed. The boss bawled me out while the blood splattered around and proceeded to show me what I should have done. "Now isn't this a hell of a time to tell me how to do it?" I stormed, and immediately left the shop for the plant hospital. This is what I meant by hit-and-miss method of training. With proper supervision I would have avoided a painful experience.

John Homewood
Ontario, Calif.

•

BARGAIN SHOPPER

AT THE PRESENT TIME, when the demand for labor is greater than the supply, the price automatically goes up. The employees bring about the increase, by shopping around and requesting bids for their services. The employer must increase the wage rate to keep his men on the job. By elevating the wage rate in his plant, he is also inviting outside help to join his forces. A concern working on last week's contract cannot pay this week's wage rate unless it takes a loss. A concern working on civilian goods in a competitive field cannot raise its selling price to pay higher wages without risking a loss in business.

Firms receiving war contracts have made allowances for an increase in labor costs or at least considered the present rate, allowing them to offer a higher rate and attract other workers to their doors. The manufacturer of a fixed price article is forced to shut down or accept war work to permit a higher wage rate.

An employee soon finds out where he can offer his services for a higher rate than he is now able to collect. This information is found on the classified advertisement page of the local paper, or through friends. The manufacturer is always looking for a new market for his product and watches the trade news to determine when he can raise the selling price. The employee does the same thing. He has a service to offer and looks for the best market. He continues to

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INDUSTRY CHOOSES . . . . .

LOGAN LATHES
FOR PRODUCTION

Results obtained through many years on work of wide variety have established the Logan Lathe as a production tool. Industry chooses and uses more Logan Lathes than ever because Logan versatility, efficiency, durability and economy pay off in profitable production.

THESE LOGAN CHARACTERISTICS WILL HELP YOUR PRODUCTION

CAPACITY . . .
With 1" collet capacity, 11" swing, 1⅜" spindle hole and center distances of 24" and 36", Logan Lathes have the size to handle substantial work.

ACCURACY . . .
Less than .0005" spindle runout 12" from the bearing . . . two V-ways and two flat ways precision ground to within .0005" variation . . . these are typical Logan Lathe construction tolerances.

VERSATILITY . . .
The Logan Lathe gives you spindle speeds of 45 to 1500 rpm with no bearing adjustment. A complete line of accessories further equips these versatile tools for every type of lathe operation.

RUGGEDNESS . . .
With its ball bearing mounted spindle, its self-lubricating bronze bearings at vital wear points, and its rugged overall construction, the Logan Lathe retains its accuracy and dependability under constant use.

ECONOMY . . .
By reducing power costs; by saving vital floor space; by quick, easy set-ups; by lasting accuracy and low maintenance; Logan Lathes put many metal turning operations on an economical and profitable basis. The saving to be realized on your original investment in Logan Lathes is a further economy well worth considering.

LOGAN NO. 925
11" Quick Change Gear Cabinet Lathe;
1" Collet Capacity, 1⅜" Spindle Hole,
24" and 36" Center Distances
One of the 37 Models of Logan
10" and 11" Swing Lathes

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LOGAN ENGINEERING CO.

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cuts costs on

TOUGHEST

hack sawing jobs

Tough heavy rails, their surface hardened by the constant hammering of passing trains, are notoriously rough on hack saw blades. In test after test, "Blu-Mol" has proved its ability to outperform other blades for this rugged work.

Time after time, cuts per blade average 50% to 100% higher — costs take a nose dive when "Blu-Mol" goes on the job. As a result more and more leading railroads are adopting "Blu-Mol" as their standard hack saw blade.

"Blu-Mol" is just one of the outstanding performers in the Millers Falls line. For other applications, you can count on tremendous savings with "Jet-Edge,"® the new welded-edge power blade that is *unbreakable* in use. And when it comes to hand blades, there's super-tough, super-flexible "Tuf-Flex,"® "Blu-Mol" in hand sizes, and "Blu-Flex,"® the remarkable new *flexible* high speed hand blade.

You're on the right track to lower costs when you switch to Millers Falls for all your industrial hack sawing. Write for full details, or let us arrange a convincing demonstration on your own work in your own machines.

MILLERS FALLS COMPANY, GREENFIELD, MASS.

THE WORLD'S BROADEST AND MOST ADVANCED LINE OF METALCUTTING SAWS

MILLERS FALLS TOOLS SINCE 1868®

The Mark of Superiority

search the market and investigates all possible leads.

The company offering the highest rate is not labor stealing, it is generally meeting the demands of the labor market. If it produces a product of better quality and lower price it says in business.

When a group of manufacturers bid on a war contract they know that it is expected of them to pay a higher rate of pay and take account of the fact in their bids. Because of the conditions of most of the contracts, only a certain group of companies are in a position to offer an acceptable bid which somewhat eliminates competition. Since a company is investigated to determine the facilities or organization an undesirable concern can be eliminated from the field.

The civilian manufacturer must ask ridiculous prices to meet the ever mounting costs he encounters by competing with the war manufacturer. With the manufacturer paying under the counter for his material and it is not a secret, why should he be accused of labor-stealing because he offers a higher rate than his competitor? When there is a black market on material every one accepts the condition, but as soon as the labor market is affected, the companies are accused of labor-stealing. There is no reasonable solution to the problem at this time, and if the government tries any of their controls they will only aggravate the condition.

Control of wage rates is not practical since there are too many other factors to be considered. There is nothing to prevent a company to lay off all their help today and re-hire them tomorrow at a higher rate.

Frank J. Zarnowski
Rutherford, N. J.

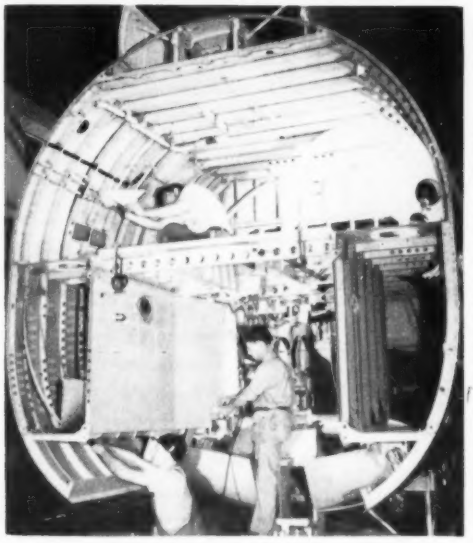
•

IN A FREE COUNTRY, a man or a woman is free to move as circumstances or fancy dictate. To think or argue otherwise is, in the case of a foreman or personnel officer, merely to run away from facts and logic. Why should manual workers, alone, be so shackled while the white-collar fraternity are accorded complete freedom of action in the matter of job preference?

Money, alone, is not the cause of every change; many other factors play a part. A man may like or dislike a certain town or district, a certain workshop, foreman, or class of work, etc. In fact, there would seem to be almost no end to possible reasons for a man seeking a change

Continued on p. 196

subcontracting NEWS



Inner details of fuselage section of B-47 Stratojet under construction by Boeing are revealed here, giving indication of size of the swept-wing six-jet bomber. Lockheed will build B-47's at Marietta, Ga., and Douglas will build the plane at Tulsa, supplementing substantial production already under way at Boeing's Wichita plant

Chicago Manufacturers Active In Defense Work, Survey Shows

CHICAGO — Nearly two-thirds of Chicago manufacturers responding to a questionnaire sent them by the Chicago Association of Commerce and Industry reported that they have defense contracts.

Nearly all (96.7%) of the manufacturers holding contracts are actually in production on defense work. However, half of those with contracts reported that they are still in the tooling up stage for some of the defense work they have been awarded.

The association's survey, based upon a response from 400 manufacturing companies, also revealed:

(1) That nearly three quarters of the manufacturers responding are actively seeking defense contracts at the present time;

(2) That 72% of those seeking contracts have been successful in acquiring them; and

(3) That some manufacturers are receiving defense orders faster than they can handle them, without any solicitation.

Half of the manufacturers who have defense contracts are operating both as prime and subcontractors on defense orders. Another third are operating only as subcontractors, and the remaining firms reported that they are operating as prime contractors only.

Air Force Plans Permanent Business Clinics

CHICAGO—Six permanent Air Force defense clinics, designed to aid small business firms in the Midwest, will be activated in the near future, officials of the Midcentral Air Procurement District announced.

The permanent exhibits will be located in Chicago, Milwaukee, Minneapolis, St. Louis, South Bend, and Indianapolis. They will serve small business firms through 12 Midwestern states in which the Midcentral Air Procurement District at present oversees 2115 Air Force contracts worth more than $2 billion. The sum is the highest since the peak defense spending years of World War II, and is an amount nearly 11 times greater than the $185 million total in July of last year.

GMC's Ternstedt Division To Make AF Compasses

DETROIT—The Ternstedt Div., General Motors Corp., has been awarded a contract by the United States Air Force for the production of N1 compass systems.

The instrument was developed by Kearfoot Co., Little Falls, N. J., and will be produced by Ternstedt under a licensing agreement which also provides engineering assistance. Production will be in the division's instrument plant, Detroit.

Plans call for many of the instrument components to be purchased from outside suppliers.

74% of Army Medical Contracts Go to Small Firms

WASHINGTON — Small business firms are receiving the major portion of Army medical supply contracts the Defense Dept. has announced.

Of 3291 procurement contracts awarded during the latest month for which figures are available, 2444 or 74.3% went to firms employing less than 500 persons. Dollar value of contracts awarded ran slightly behind this figure; 64.6% of over $16 million for the month.

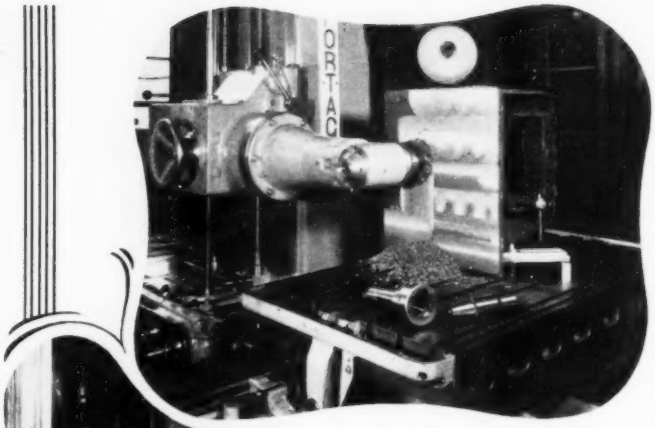
These figures represent prime contracts and do not show the amount of business being handled by small firms under sub-contracts.

Kaiser's Aircraft Program Uses 700 Suppliers

DETROIT—Kaiser-Frazer has given commitments for more than 700 companies to supply parts and raw materials for the Air Force contract to build Fairchild's C-119 "Packet" at Willow Run.

Kaiser-Frazer itself is making about 60% of the airframe components. To accomplish this, K-F is depending on small businesses; of the 712 suppliers, more than one third employ fewer than 100 persons. Suppliers include companies in 257 cities and 26 of the 48 states.

K-F also has contracts to produce parts for the Wright engine at Detroit, and subassemblies for Lockheed aircraft at Oakland, Calif.



RIGHT ANGLE HEAD ATTACHMENT

adds versatility to

Portage

HORIZONTAL BORING MILL OPERATIONS

The two views shown illustrate the versatility of the Portage Right Angle Head Attachment on milling operations. This handy attachment, designed and developed by Portage, offers many short cuts, saves time, and reduces costs on various milling and drilling operations.

For example on the job shown, the milling spindle is in a horizontal position face milling vertical surfaces on a casting. Below, the head is turned 90° and the cutter machines a horizontal internal top surface in a hole in the same casting without resetting the work. The head is radially adjustable through 360°.

The sturdy construction of both machine base and column affords rigid support to Right Angle Head Attachment and results in appreciable savings in time and costs.

Note the quick change tool holder on the table of the top illustration. This device not only permits easy, quick change of tools but assures perfect alignment.

Write us for complete information on either the Right Angle Head Attachment or the Quick Change Tool Holder.

THE PORTAGE MACHINE COMPANY

AKRON, OHIO . . . ***Dealers in all principal cities***

LATEST DEFENSE

ARMY ORDNANCE AWARDS

Tank Automotive Center, Detroit

DeVilbiss Co., Toledo—air compressor, nonportable.

Kent Moore Org., Inc., Detroit—headlight tester.

Mechanics Universal Joint Div., Borg-Warner Corp., Rockford, Ill.—propeller shaft kit.

Pioneer Gen-E-Motor Corp., Chicago—battery charger, portable.

Westinghouse Electric Corp., Detroit—portable welder, selenium rectifier.

Storm-Vulcan, Inc., Dallas, Texas—automotive parts cleaner.

Champion Spark Plug Co., Toledo—cleaner and tester, spark plug.

A.C. Spark Plug Div., GMC, Flint, Mich.—cleaner and tester, spark plug.

Mack Mfg. Corp., Washington—tenton stake, diesel truck.

Neff Equipment Co., Toledo—voltage regulator.

Truck & Coach Div., GMC, Pontiac, Mich.—trucks.

International Harvester Co., Washington—trucks.

Federal Motor Truck Co., Detroit—trucks.

Gramm Trailer Corp., Lima, Ohio—semi-trailer, gasoline.

Fruehauf Trailer Co., Detroit—semi-trailer, tank, gasoline.

J. M. Nelson Mfg. Co., Ottawa, Ohio—semi-trailer, low bed, 50 ton.

Dorsey Trailers, Inc., Elba, Ala.—semi-trailer.

Auto-Test Inc., Chicago—battery tester, Universal.

White Motor Co., Cleveland—truck tractor.

Frankfort Arsenal, Philadelphia

Hobart Bros. Co., Troy, Ohio—spare parts, generator unit.

Electric Auto-Lite Co., Toledo,—assembly distributor.

Star Watch Case Co., Ludington, Mich.—case assembly.

Wakmann Watch Co., New York—navigation watches.

Machinery Associates, Philadelphia—lathes.

International Spare Parts Corp., Long Island City, N. Y.—spare parts, generating units.

Eagle Electric Mfg. Co., Long Island City, N. Y.—spare parts, gun director.

Smith Drum Co., Philadelphia—test stand, oil, gears.

Kerns Mfg. Co., Long Island City, N. Y.—hydraulic drive.

Nichols-Morris Co., New York — milling machines.

Fee & Stemedal Co., Chicago—compass and equipment.

Springfield Ordnance District

Marlin Fire Arms, New Haven, Conn.—barrel assembly.

Casco Products Corp., Bridgeport, Conn.—initiator burster.

U. S. Time Corporation, Waterbury, Conn.—fuse.

Ex-Cell-O Corporation, Detroit—machines.

New York Ordnance District

W. L. Maxon Corp., New York—motors, dynamic testers.

Rudolph Wendel, Inc., New York—periscopes.

American Crystoscope Makers, Inc., New York—telescopes.

Newark Boiler Regulator Co., Bloomfield, N. J.—spare parts, fire control.

Hardy Plastics & Chemical Corp., Brooklyn, N. Y.—adapters.

Dellenbarger Machine Co., New York—spare parts, fire control program.

CONTRACTS

Daystrom, Inc., Elizabeth, N. J.—fire control system.
Control Instrument Co., Brooklyn, N. Y.—spare parts, fire control.
Western Electric Co., New York—spare parts, gun director.
Mergenthaler Linotype Co., Brooklyn, N. Y.—range finders.
Camburn, Inc., Woodside, Long Island, N. Y.—spare parts, fire control.
Foremost Machine Builders, Inc., New York—spare parts, fire control program.

Watervliet Arsenal, N. Y.

Pipe Machinery Co., Cleveland—inspection gages.
Buffalo Arms, Inc., Buffalo, N. Y.—cannon parts.
Worthington Mower Co., Stroudsburg, Pa.—cannon parts.
Richmond Foundry & Mfg. Inc., Richmond, Va.—cannon parts.

Detroit Ordnance District

A. C. Spark Plug Div., GMC, Flint, Mich.—service parts, tank-automotive.
Gar Wood Industries, Wayne, Mich.—automotive parts.
Wolverine Boat Co., Detroit—spare parts, tank-automotive.
Deubel Art Tool & Machine Co., Detroit—service parts, automotive.
Rett Products Co., Detroit—automotive parts.
Dusevoir Metal Products, Detroit—automotive parts.
Lapton Machine Tool Co., Hazel Park, Mich.—parts, tank-automotive.
S. J. Corbett Company, Detroit—automotive parts.
Reo Motors, Inc., Lansing, Mich.—trucks.
AC Spark Plug Div., GMC, Flint, Mich.—automotive parts.

ENGINEER AWARDS

New York Engineer District

Q-O-S Corp., New York — stereocomparagraph.
American Type Founders, Inc., Elizabeth, N. J.—spare parts, presses.
Hercules Food Service Equipment, Inc., Brooklyn, N. Y.—kitchen equipment.
A. L. Cahn & Sons, Inc., New York—kitchen equipment.
Grayson Equipment Co., Newark, N. J.—hospital mess equipment.
Central Automatic Sprinkler Co., Landsdale, Pa.—complete sprinkler systems.

SIGNAL CORPS AWARDS

Philadelphia Procurement Agency

Reiner Electronics Co., Inc., New York—test set.
Automatic Electric Sales Corp. Chicago—telephone switchboard, repair parts.
Federal Telephone & Radio Corp., Clifton, N. J.—telegraph terminal.
Western Electric Co., New York—telephone control terminal.
Automatic Mfg. Corp., Newark, N. J.—transformers.
Cyclohm Motor Corp., Div. of Howard Industries, Inc., Racine, Wis.—power unit.
Webster-Chicago Corp., Chicago—recorder-reproducer set.
Herbert Kerkow, Inc., New York—motion picture production.
Friez Instrument Div., Bendix Aviation Corp., Baltimore, Md.—radiosonde.
Mark Simpson Mfg. Co., Inc., New York—public address set.
David Bogen Co., Inc., New York—public address set.
Daven Co., Newark, N. J.—generator.

NAVY AWARDS

Navy Purchasing Office
Washington 25, D. C.

Ingersoll-Rand Co., Washington—air compressors.
Jones & Lamson Machine Co., Springfield, Vt.—turret lathes.
Tubular Micrometer Co., St. James, Minn.—machinists calipers, micrometers, and scrapers.
George W. Warner & Co., Inc., New York—threading set, right hand tap.
Greenfield Tap & Die Corp., Greenfield, Mass.—threading sets, screw and bolt.

Bureau of Ships
Washington 25, D. C.

American Electric Welding Co., Baltimore, Md.—harbor tug.
Wiley Mfg. Co., Fort Deposit, Md.—harbor tug.
Romer Boat Co., Holland, Mich.—harbor tug.
Missouri Valley Steel, Inc., Leavenworth, Kan.—passenger boat, cargo boat.
Hagens, Inc., New Orleans, La.—cargo boat, passenger boat.
National Steel & Shipbuilding Corp., San Diego, Calif.—passenger boat, cargo boat, and harbor tugs.
Avondale Marineways, Inc., Westwego, La.—harbor tugs, diesel.
Olsen Corp., Berresford, Fla.—harbor tug.
Kyle & Co., Inc., Fresno, Calif.—lighter barge.
Worthington Pump & Machinery Corp., Washington—electric pumps.
Seattle Shipbuilding & Drydock Corp., Seattle, Wash.—mine sweepers.
Stephens Bros., Inc., Stockton, Calif.—minesweepers.
Broward Marine Inc., Fort Lauderdale, Fla.—minesweepers.
Johnson Motors, Div. Outboard Marine & Mfg. Co., Waukegan, Ill.—outboard motors, 25 hp.
Towner Mfg. Co., Santa Ana, Calif.—trestles.

Philadelphia Naval Shipyard

Cutler-Hammer, Inc., Philadelphia — repair parts, contactor.
Ward Leonard Electric Co., Philadelphia—repair parts air compressor.
Westinghouse Electric Corp., Philadelphia—repair parts, air cleaner, controller, battery, ventilating fans, etc.
American Laundry Machinery Co., New York—laundry equipment.

Gerity-Michigan To Subcontract For Packard

DETROIT—The Gerity-Michigan Corp., Adrian, Michigan, has received an order from the Packard Motor Car Co., Detroit, to manufacture compressor front frames, in connection with production by Packard of the "dash 23" version of the J-47 turbojet engine.

The J-47, which Packard is to build as a prime contractor for the U.S. Air Force under a licensing agreement with General Electric Co., has been designated for the Boeing B-47 Stratojet, claimed to be the world's fastest bomber.

Dravo Corporation, Philadelphia—spare parts and components.
Sun Shipbuilding & Drydock Co., Chester, Pa.—gate valves.
Electric Storage Battery Co., Philadelphia—repair parts, submarine batteries.

Bureau of Ordnance
Washington 25, D. C.

Aldon Products Co., Duncannon, Pa.—fuzes, exceeds $250,000.
Free Sewing Machine Co., Rockford, Ill.—auxiliary detonating fuzes, exceeds $250,000.
Farrand Optical Co., Inc., New York—boresights, $225,355.
Baldt Anchor Chain & Forge Div., Boston Metals Co., Chester, Pa.—light weight anchor, exceeds $250,000.
Nero Ordnance Corp., Div. Northern Engraving & Mfg. Co., La Crosse, Wis.—cartridge cases, exceeds $250,000.

New York Purchasing Office

Presto Recording Corp., Hackensack, N. J.—electronic navigation trainer.
All American Airways, Inc., Wilmington, Del.—ejection seat trainer, and parts.
Dellenbarger Machine Company, Inc., New York—sub caliber firing devices spare parts.

Ships Parts Control Center
Mechanicsburg, Pa.

General Electric Co., Philadelphia—repair parts, turbines, motors, controls, switch gears, meters and transformers.
Cleveland Diesel Engine Div., GMC, Cleveland—repair parts, diesel engine.
Fairbanks, Morse & Co., New York—repair parts, diesel engine.
Bayer Company, St. Louis, Mo.—repair parts, soot blowers.
New York Shipbuilding Corp., Camden, N. J.—repair parts, oil burners.
Atwood & Morrill Co., Salem, Mass.—repair parts, automatic sprinkling.

Quartermaster General (USMC)
Washington 25, D. C.

Mervin & Kretchmer, Inc., Hackensack, N. J.—steam tables.
Union Steel Products Co., Albion, Mich.—bakery equipment.
Harris-Seybold Company, Cleveland—offset presses.
Libbey Welding Co., Kansas City, Mo.—welders.

NAVAL AVIATION AWARDS

Aviation Supply Office
Philadelphia 11, Pa.

Saval Div., William R. Whittaker Co., Ltd., Los Angeles, Calif.—aircraft valves.
Thompson Products, Inc., Cleveland—pump assembly.
Link Aviation, Inc., Binghamton, N. Y.—spare parts, special devices.
Stewart-Warner Corp., Indianapolis—heater, combustion, separate filters, aircraft.
Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.—shock strut assembly, aircraft.
Lavoie Laboratories, Inc., Morganville, N. J.—signal generators, oscillascopes.
Federal Mfg. & Eng. Corp., Brooklyn, N. Y.—signal generator.
Airborne Accessories Corp., Hillside, N. J.—actuators.
American Chain & Cable Co., York, Pa.—bomb and torpedo lift truck.
Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.—tools, test equipment.

At your service for **SHEET METAL SUBCONTRACTS!**

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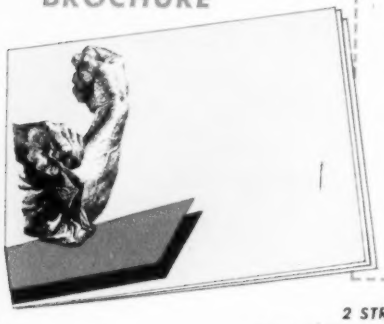

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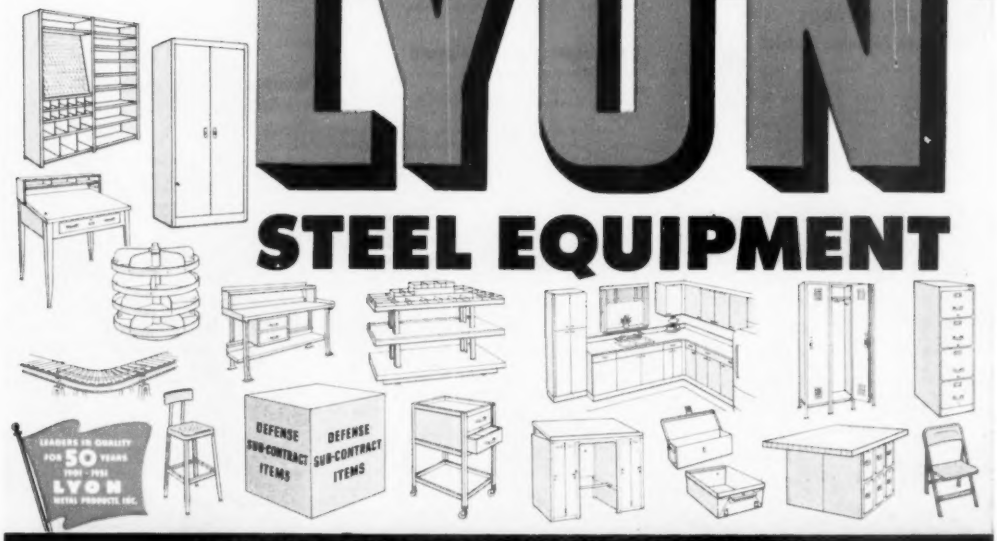
STEEL EQUIPMENT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DEFENSE SUB-CONTRACT ITEMS
DEFENSE SUB-CONTRACT ITEMS

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• Stools	• Storage Cabinets	• Tool Boxes	• Tool Room Equipment	• Revolving Bins	• Work Benches	• Drawer Units	• Tool Trays
• Bin Units	• Welding Benches	• Parts Cases	• Wood Working Benches	• Hanging Cabinets	• Bench Drawers	• Hopper Bins	• Shop Desks

NAVY AVIATION . . . continued

Lewis-Sheppard Products, Inc., Watertown, Mass.—bomb and torpedo lift trucks.

Gray Iron Casting Co., Mount Joy, Pa.—bomb and torpedo lift truck.

General Electric Co., Philadelphia — test equipment.

Douglas Aircraft Co., El Segundo, Calif.—generators.

Electric Products Co., Cleveland—frequency converters.

Loral Electronics Corp. New York—test sets, portable.

Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Washington—temperature regulation valve.

O. E. Szekely & Associates, Inc., Philadelphia—signal generator.

Weston Electrical Instrument Corp., Philadelphia—voltmeter, dc.

American Engineering Co., Columbus, Ohio—test stand, hydraulic system.

Magnovox Co., Fort Wayne, Ind.—solenoid, armament.

Hazeltine Electronics Corp., Little Neck, Long Island, N. Y.—spectrum analyzer, attenuators, and modulators.

Aircooled Motors, Inc., Syracuse, N. Y.—maintenance parts, engines, crankshaft assembly.

Chicago Industrial Instrument Co., Chicago—voltmeter.

Daven Co., Newark, N. J.—frequency meter.

Howard C. Sooy & Co., Clinton, Mass.—accessory kits.

Radio City Products Co., New York—voltmeter.

Grumman Aircraft Engineering, Bethpage, Long Island, N. Y.—aviation armament spares.

Anchor Equipment Co., San Francisco, Cal.—valves, steel.

Pesco Products Division, Borg-Warner Corp., Bedford, Ohio—pump assemblies.

Airborne Accessories, Corp., Hillside, N. J.—actuator, rotor.

Belmont Radio Corp., Chicago—radio direction finder, exceeds $250,000.

Cincinnati Electronics Co., Cincinnati—radio receivers, exceeds $250,000.

Radio Receptor Co., Brooklyn, N. Y.—radio transmitters, exceeds $250,000.

Houston Fearless Corp., Los Angles, Calif.—magazines, spare parts, special tooling, $201,720.

Bill Jack Scientific Instrument Corp., Solano Beach, Calif.—cameras, related equipment, spare parts, exceeds $250,000.

Robbins & Meyers, Inc., Springfield, Ohio—engine hoist, exceeds $250,000.

Nuarc Co., Chicago—light, spare parts, $172,806.

Lambert Engineering Co., St. Louis—ejector, $192,078.

Bell & Howell, Chicago—projector & spare parts, exceeds $250,000.

Union Twist Drill Co., Athol, Mass.—cutter, milling gear $28,164.

Revere Camera Co., Chicago—camera, spare parts, exceeds $250,000.

Fairchild Camera & Instrument Corp., Jamaica, L. I., N. Y.—photographic equipment, spare parts, exceeds $250,000 each of 4 contracts.

Bausch & Lomb Optical Co., Rochester, N. Y.—misc. photo equipment, exceeds $250,000.

Chicago Aerial Survey Co., Chicago, Ill.—magazines, spare parts, exceeds $250,000.

Springfield Machine Tool Co., Springfield, Ohio—geared head, engine lathe, $239,474.

Republic Aviation Corp., Farmingdale, L. I., N. Y.—F-84G mobile training units, exceeds $250,000.

Cessna Aircraft Co., Wichita, Kansas—spare parts, exceeds $250,000.

Federal Mfg. & Engineering Corp., Brooklyn, N. Y.—radio set, exceeds $250,000.

Webster-Chicago, Inc., Chicago—radar set, exceeds $250,000.

Metal Industries, Inc., Indianapolis—metal shipping containers, $200,250.

Keene S. Jackson, Glendale, Calif.—gun sight parts, $176,460.

Hercules Motors Corp., Canton, Ohio—spare parts, engines, $219,941.

Goodyear Tire & Rubber Co., Akron, Ohio—wheel assemblies and brake assemblies, $156,654.

Gibbs Mfg. & Research Corp., Janesville, Wisc.—components, Doppler Drift System, $214,586.

Kearfott Co., Inc., Little Falls, N. J.—master indicators, $245,000.

Lockheed Aircraft Corp., Burbank, Calif.—kits and assemblies, sub-assemblies, $114,240.

P. R. Mallory & Co., Inc. Indianapolis—rectifier, $103,850.

Van Norman Co., Springfield, Mass.—milling machines, $172,620.

Independent Pneumatic Tool Co., Aurora, Ill.—air hammers, electric drills sanders & impact wrenches, exceeds $250,000.

Chicago Pneumatic Tool, Detroit—riveting hammers, pneumatic, exceeds $250,000.

Mine Safety Appliance Co., Pittsburgh—mask, oxygen, pressure, exceeds $250,000.

Acushnet Process Co., New Bedford, Mass.—mask, oxygen, pressure exceeds $250,000.

Olympic Radio & Television, Inc., L. I., N. Y.—radio set, exceeds $250,000.

Aircraft Tools, Inc., Los Angeles, Calif.—dimpling unit, pneumatic, portable, exceeds $250,000.

Butler Mfg. Co., Kansas City, Mo.—trailers, spare parts, exceeds $250,000.

Standard Molding Corp., Dayton—emergency lamp assembly, $128,250.

Emerson Electric Mfg. Co., St Louis—air circulating fan, exceeds $250,000.

Hunter Fan & Ventilating Co., Memphis, Tenn.—air circulating fan, exceeds $250,000.

Niles Tool Works Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio—wing turret lathe, exceeds $250,000.

Sperry Gyroscope Co., Great Neck Long Island, N. Y.—misc. tools, $191,435.

ACF Brill Motors Co., Philadelphia—power plant, exceeds $250,000.

Harry A. Lowther Co., Shelbyville, Ind.—towing vehicles, spare parts, exceeds $250,000.

Continental Motors Corp., Muskegon, Mich.—packette engines, exceeds $250,000.

Military Services Publish Procurement Standards

WASHINGTON—Three volumes of the Military Index of specifications and standards used by the services for procurement are now available. Vol. I lists the MIL and JAN specifications and standards that have been adopted by all three military services—Army, Navy, and Air Force.

In addition to this general index, each service publishes its own procurement standards: the Navy, Military Index Volume III; the Air Force, Volume IV. The volume published by the Army (Volume II) is still in process but copies are expected shortly.

Each volume is to be published semi-annually. In the interim, cumulative monthly supplements will keep them up to date. Copies can be obtained from the Government Printing Office, Washington 25, D. C. The supplement service is included in the price—$2.75 for each semi-annual volume.

Marlow Pumps, Ridgewood, N. J.—pump kits, spare parts, $150,000.

Avildsen Tools & Machines, Inc., Chicago, Ill.—drill, exceed $250,000.

Marmon-Herrington Co., Indianapolis—crash fire trucks, exceeds $250,000.

Ingersoll-Rand Co., Cincinnati—compressors, exceeds $250,000.

Stewart-Warner Corp., Indianapolis—heaters, $120,217.

Chicago Pneumatic Tool Co., Detroit—compressor, exceeds $250,000.

Cleveland Pneumatic Tool Co., Cleveland—air springs, maintenance parts, exceeds $250,000.

Air Products, Inc., Emmons, Pa.—maintenance parts, generator, $121,575.

Lincoln Metal Products Corp., Brooklyn, N. Y.—metal shipping containers, exceeds $250,000.

Garden City Plating & Mfg. Co., Chicago—floodlights, exceeds $250,000.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.—stand assy, test direct fuel, injection nozzle, supply tanks, exceeds $250,000.

Surface Combustion Corp., Toledo—heater, exceeds $250,000.

Granberg Corp., Oakland, Calif.—aircraft fuel meters, spare parts, exceeds $250,000.

Cincinnati Lathe & Tool Co., Cincinnati—drill presses, lathes, exceeds $250,000.

American Pipe & Steel Corp., Alhambra, Calif.—hydrant refueling systems, exceeds $250,000.

Propeller Div., Curtiss-Wright Aviation Corp., Caldwell, N. J.—training parts, tools and equipment.

Bendix Radio Div., Bendix Aviation Corp., Baltimore, Md.—radar sets.

North American Aviation, Inc., Los Angeles, Calif.—tanks, aircraft.

Eicor, Inc., Chicago—inverters.

Keystone Watch Case Div., Riverside Metal Co., Riverside, N. J.—landing gear indicators.

Schwien Eng. Co., Los Angeles, Calif.—indicators.

Leland Electric Co., Dayton—inverters.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.—indicators.

Blackstone Mfg. Co., Chicago—indicators.

Electronics Div., Curtiss Wright Corp., Caldwell, N. J.—instrument flying trainers.

Westinghouse Electric Corp., Dayton—generators.

Sperry Gyroscope Co., Sperry Corp., Great Neck, Long Island, N. Y.—directional gyro indicator.

U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa.—transmitter, torque pressure, hydraulic pressure indicators, manifold pressure indicators.

Rauland Borg Corp., Chicago—amplifiers, single channel.

Adel Div., General Metals Corp., Burbank, Calif.—feathering pumps.

Standard Electrical Products Co., Dayton—relays.

Barber-Colman Co., Rockford, Ill.—micro-positioners, switches, and controls.

Heppner Mfg. Co., Round Lake, Ill.—heaters.

Marion Screw Products Co., Marion, Ind.—testers.

Morgan Machine Co., Inc., Rochester, N. Y.—mailing machines.

Weston Electrical Instruments Corp., Newark, N. J.—indicators.

Starrett Television Corp., New York—signal generators.

Raytheon Mfg. Co., Waltham, Mass.—machinery and equipment.

National Farm Machinery Corp., Bellevue, Ohio—oxygen-servicing trailers.

Chicago Pneumatic Tool Co., Detroit—pneumatic wrench, impact.

Fairchild Camera & Instrument Co., Jamaica, N. Y.—spare parts and cameras.

Independent Pneumatic Tool Co., Aurora, Ill.—electric wrenches.

Vought Co., Beverley Hills, Calif.—camera bodies and magazines.

Studebaker Corp., South Bend, Ind.—machinery and equipment for constructing test cells.

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Wright-Patterson A. F. Base, Dayton

Sperry Gyroscope Co., Great Neck, L.I., N.Y.—compass system components, exceeds $250,000.

Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.—regulators and generators, exceeds $250,000, inverters, exceeds $250,000.

General Electric Co., Schenectady, N.Y.—turbo-jet aircraft engines, exceeds $250,000.

Douglas Aircraft Co., Inc., Santa Monica, Calif.—mobile training units, complete, exceeds $250,000.

Maxson Engineering Div., New York—amplifiers, exceeds $250,000.

Transducer Corp., Boston — radar traing sets, exceeds $250,000.

Hoffman Radio Corp., Los Angeles, Calif. — azimuth indicators, exceeds $250,000.

Air Associates, Inc., Teterboro, N.J.—radio sets, exceeds $250,000.

Automatic Electric Sales Corp., Chicago—telephone switchboards, exceeds $250,000.

Texas Engineering & Mfg. Co., Dallas, Texas—cycle maintenance inspection, exceeds $250,000.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.—wheel and brake assemblies, exceeds $250,000.

Goodyear Tire & Rubber Co., Inc., Akron, Ohio—wheel and brake assemblies, exceeds $250,000.

Pacific Airmotive Corp., Burbank, Calif.—cycle reconditioning of aircraft, exceeds $250,000.

Radioflame Co., Van Nuys, Calif.—target aircraft, $147,003.

Curtiss-Wright Corp., Caldwell, N.J.—instrument flying trainers, $100,000.

Boeing Airplane Co., Seattle, Wash.—modification and retrofit kits, aircraft, exceeds $250,000.

American Air Motive Corp., Miami Springs, Fla.—services and materials to overhaul 68 engines, $210,800.

North American Aviation, Inc., Los Angeles, Calif.—aircraft remanufacture, exceeds $250,000.

Jack & Heintz Precision Industries, Inc., Cleveland—inverters, $144,708.

Curtiss-Wright Corp., Electronics Div., Caldwell, N.J.—ground instrument flying trainer, exceeds $250,000—simulator trainer exceeds $250,000.

Western Electric Co., Inc., New York—cavities, $139,950.

Fairchild Camera & Instrument Corp., Jamaica, N.Y.—echo box, $231,-341.

Steel Products Engineering Co., Springfield, Ohio—bomb hoists, exceeds $250,000.

Newman Machine Co., Greensboro, N.C.—wood jointers, $171,307.

Sheldon Machine Co., Inc., Chicago—bench-type lathes, $122,704.

Seifreat Elstad Machinery Co., Dayton—grinders, $233,695.

Stamford Electronics Co., Stamford, Conn.—pulse generator, exceeds $250,-000.

Standard Steel Works, Kansas City, Mo.—refueling trailers, exceeds $250,-000.

Republic Aviation Corp., Farmingdale, L. I., N. Y.—machinery and equipment, exceeds $250,000.

Dana Corp., Toledo, Ohio — engine gears, exceeds $250,000.

Hydro-Aire, Inc., Burbank, Calif.—machinery and equipment, $150,000.

Aluminum Co. of America, Pittsburgh—horizontal extrusion press, exceeds $250,000.

Harrison Sheet Steel Co., Chicago—office tables, $228,927.

Trav-Ler Radio Corp., Chicago—audio scillator, exceeds $250,000.

Central Research Labs., Inc., Red Wing, Minn.—standing wave meters, $109,428.

Air Cooled Motors, Inc., Syracuse, N. Y.—aircraft engine, spare parts, special tools, exceeds $250,000.

Cook Electric Co., Chicago—inverter change-over, $177,000.

Consolidated Vultee Aircraft Corp., San Diego, Calif.—services and material modification, B-36, exceeds $250,000.

A. C. Spark Plug Div., GMC, Flint, Mich.—spark plug, exceeds $250,000.

Fletcher Aviation Corp., Pasadena, Calif.—aluminum fuel tanks, exceeds $250,000.

Lear, Inc., Grand Rapids, Mich.—indicators, vertical gyro, remote, exceeds $250,000.

Beach Aircraft Corp., Wichita, Kansas—T-36A twin engine transport, exceeds $250,000.

Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn.—radial drill presses, $145,849.

Northwestern-Weiss Mfg. Corp., Milwaukee, Wis.—ramp assemblies, 138,060.

Collins Radio Co., Cedar Rapids, Iowa—components, radio sets, exceeds $250,000.

American Chain & Cable Co., Detroit—release assembly, $112,064.

Houdaille-Hershey Corp., Buffalo, N. Y.—miscellaneous spare parts, shimmy dampers, exceeds $250,000.

Thompson Products, Inc., Cleveland—overhaul air turbine fuel pumps.

Ternstedt Div., GMC, Detroit—hardware components, exceeds $250,000.

Fairchild Engine & Airplane Corp., Hagerstown, Md. — machinery and equipment for production, exceeds $250,000.

Ryan Aeronautical Co., San Diego, Calif.—facilities for production of J47 components, exceeds $250,000.

Golden State Co., Ltd., Los Angeles, Calif.—hydraulic jack axle, $201,112.

Bausch & Lomb Optical Co., Rochester, N. Y.—modification kits, $210,906.

Gar Wood Industries, Inc., Wayne, Mich.—spare parts, truck tractors, $130,390.

Roller-Smith Div., Realty & Industrial Corp., Bethlehem, Pa.—analyzers, $226,528.

(Continued next page)

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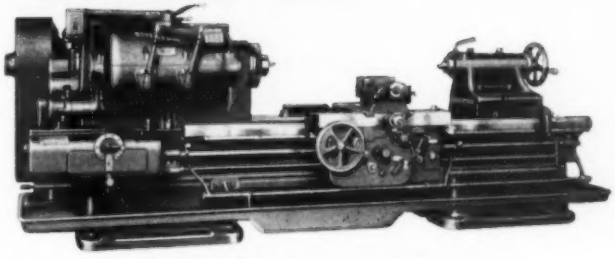

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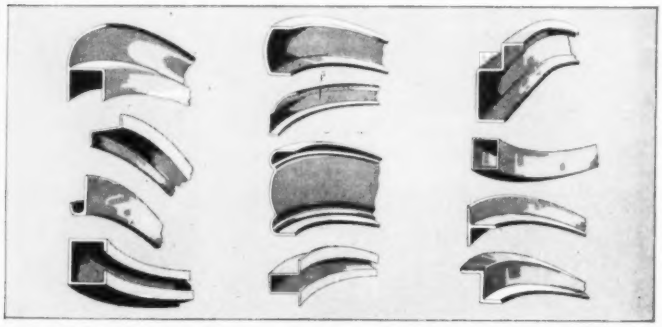
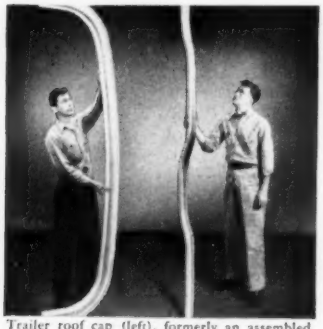
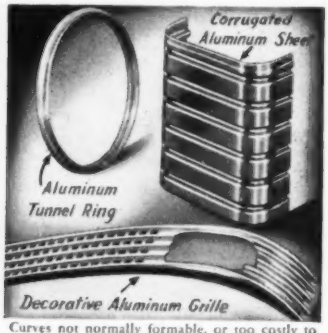


A few of the cross sections curved and bent by BATH Metal Form Division.



Trailer roof cap (left), formerly an assembled section, is formed in one piece by BATH. Coach frame (right) includes reverse bends.



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DEFENSE CONTRACTS . . . continued

Daystrom Electric Corp., Poughkeepsie, N. Y.—recorder, reproducer, exceeds $250,000.

Northern Radio Co., Inc., New York—transmitters, exceeds $250,000.

Craig Machine, Inc., Danvers, Mass.—masts, exceeds $250,000.

Bradford Machine Tool Co., Cincinnati—geared head lathes, exceeds $250,000.

All-Steel Equipment, Inc., Aurora, Ill.—cabinets, filing steel, $244,800.

Mitchell Camera Corp., Glendale, Calif.—cameras, $187,795.

Pacific Optical Corp., Los Angeles, Calif.—projectors, exceeds $250,000.

Hyatt Bearings Div., GMC, Harrison, N. J.—roller bearings, $153,150.

Greer Hydraulics, Inc., Brooklyn, N. Y.—stand assemblies, exceeds $250,000.

Sprague Engineering & Sales, Gardena, Calif.—hydraulic test stands, exceeds $250,000.

Continental Motors Corp., Muskegon, Mich.—engines, $250,000.

Brunner Mfg. Co., Utica, N. Y.—portable air compressor, $140,524.

Leland Electric Co., Dayton—inverters, spare parts, exceeds $250,000.

Piasecki Helicopter Corp., Morton, Pa.—helicopters, exceeds $250,000.

Saf-Way Steel Products, Inc., Milwaukee—engine hoists, $177,904.

Bridgeport Lycoming Div., AVCO Mfg. Co., Stratford, Conn.—J47 engine compressors, machinery and equipment, exceeds $250,000.

Sundstrand Machine Tool Co., Rockford, Ill.—airplane components, machinery and equipment.

Mattison Machine Works, Rockford, Ill.—machine tools, exceeds $250,000.

Airmotive Equipment Corp., Kansas City, Mo.—control panel, exceeds $250,000.

Philco Corp., Philadelphia—microwave systems, exceeds $250,000.

Hotpoint, Inc., Chicago—turbosuperchargers, space parts, spare components, exceeds $250,000.

Magnavox Co., Fort Wayne, Ind.—radio compasses, exceeds $250,000.

Adler Communications Lab, New Rochelle, N. Y.—radio sets, $150,000.

Hazeltine Electronics Corp., Little Neck, L. I., N. Y.—transmitters, exceeds $250,000.

Olympic Radio & Television, Inc., Long Island City, N. Y.—radio sets, exceeds $250,000.

Collins Radio Co., Cedar Rapids, Iowa—radio sets, exceeds $250,000.

Hallicrafters Co., Chicago—panoramic adapters, $151,975.

Radio Corporation of America, Camden, N. J.—radio sets, exceeding $250,000.

Hispano - Suiza Corp., Geneva, Switzerland—fire arms and ammunition, exceeds $250,000.

Phaostron Co., S. Pasadena, Calif.—multi-meters, $194,098.

Sylvania Electric Products, Buffalo, N. Y.—radio transmittaers, exceeds $250,000.

Electrolux Corp., Greenwich, Conn.—dynamoters, $188,728.

Vendo Co., Kansas City, Mo.—control panel, exceeds $250,000.

Westinghouse Electric Corp., Dayton automatic pilots, exceeds $250,000.

Fisher Research Lab, Inc., Palo Alto, Calif.—radio sets, $160,850.

Allison Div., GMC, Indianapolis, Ind.—turbojet engines, exceeds $250,000.

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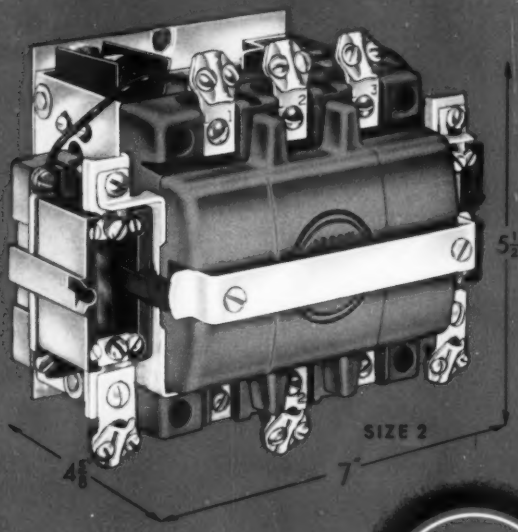
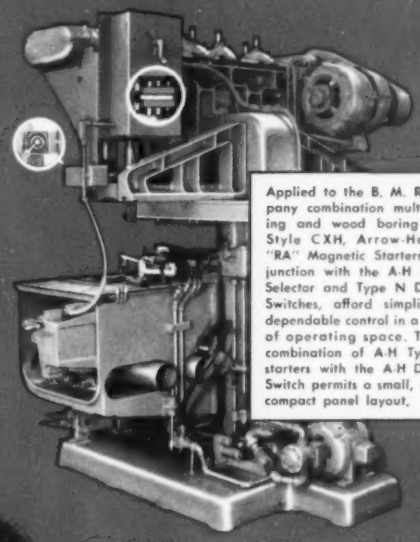




Applied to the B. M. Root Company combination multiple sawing and wood boring machine Style CXH, Arrow-Hart Type "RA" Magnetic Starters, in conjunction with the A-H Push-Pull Selector and Type N Disconnect Switches, afford simplified and dependable control in a minimum of operating space. The same combination of A-H Type "RA" starters with the A-H Disconnect Switch permits a small, unusually compact panel layout.

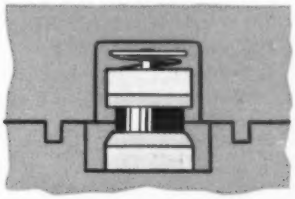
NEW TYPE "RA" MAGNETIC STARTERS

ARROW AH HART

JUST ½ THE SPACE *PLUS* FULL PROTECTION

HIGH ARC RESISTANCE

Arrow-Hart "RA" Magnetic Starters and Contactors feature a new thermosetting molding compound in the base and hood. This alkyd, with an extremely high resistance to tracking, exceeds the arc resistance of the next best material by more than 50%. It does not support combustion. The tongue and groove design pictured at right provides individual arcing chambers around each contact. This full protection is only one of the many features that add up to outstanding performance in Arrow-Hart "RA" Magnetic Starters. For more of the story, see next page.



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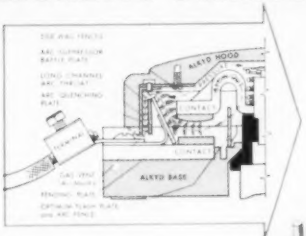
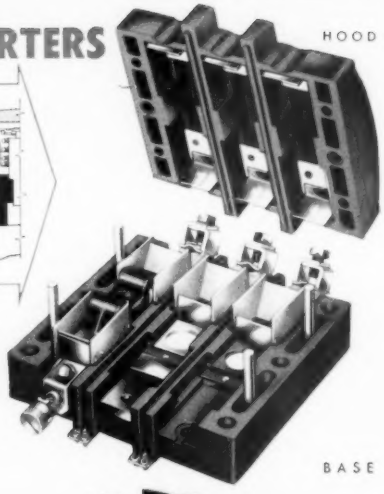
TYPE "RA" MAGNETIC STARTERS

MAXIMUM SAFETY



All A-H Magnetic Starters and Contactors are designed for maximum safety. The view at right shows how special protection is provided for the Size 4 (50 to 100 H.P.). This unit is designed so that the arc follows a controlled path, across and between the quenching and baffle plates. High heat-proof chutes enclose each contact. Contacts are shaped to produce a magnetic "blow-out" field within the arc fence. This field forces the arc in the correct direction for extinction.



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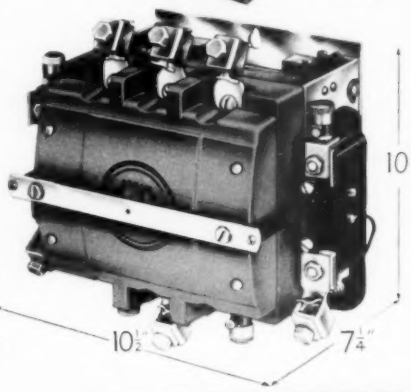
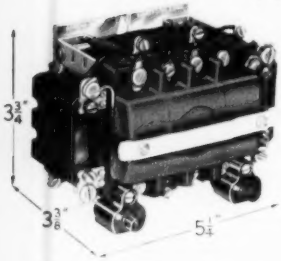
In A-H starters and contactors an exclusive new "RA" balanced mechanism multiplies leverage and increases contact pressure. It is this same mechanism that accounts for the revolutionary small size of Arrow-Hart starters. Other features are: guided parallel closures to insure contact alignment; new, bigger contacts; improved magnet and coil; plenty of wiring room; and many others. Most important of all — designers save valuable control space, reduce control equipment cavities, and cut material costs.





SIZE 0

SIZE 4

A STARTER FOR EVERY REQUIREMENT

Arrow-Hart Type "RA" Magnetic Starters and Contactors are available in a full line — Sizes 0, 1, 2, 3, and 4. For full particulars, write for Form G-7005.

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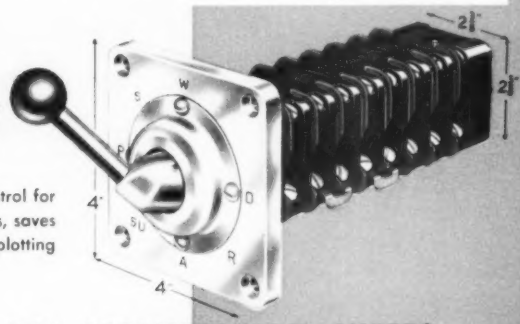

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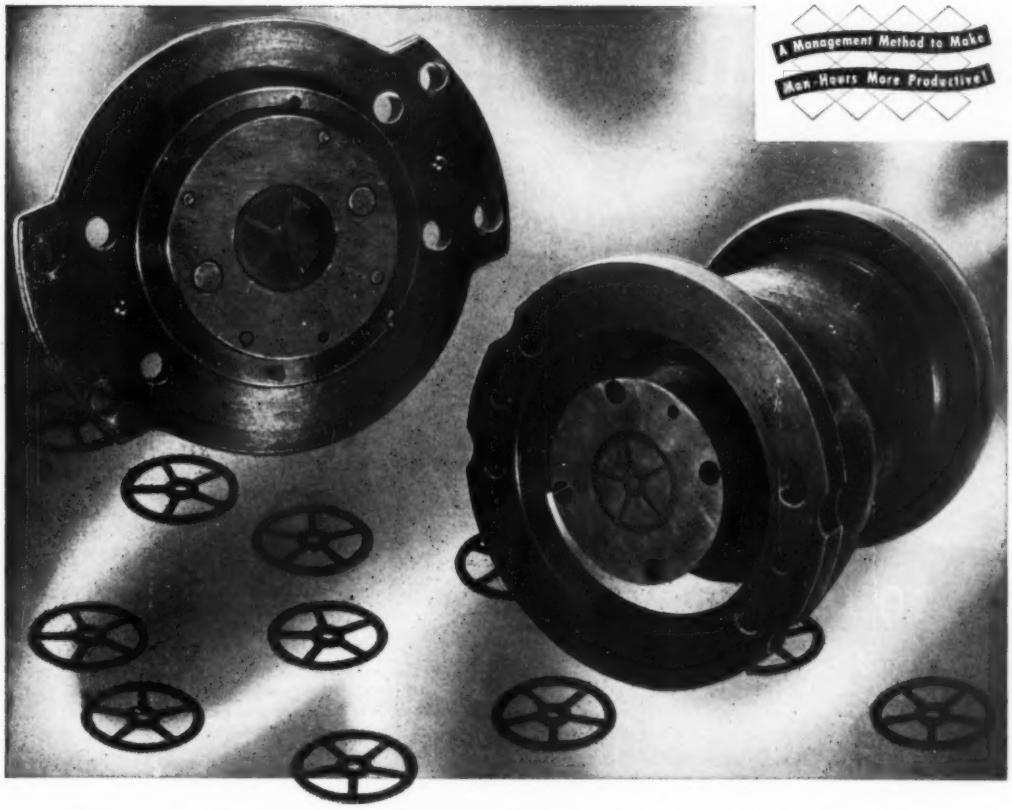

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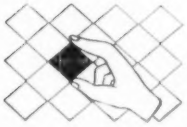


For 11 years this Stentor blanking die and punch gave trouble-free performance, averaging 100,000 gears per grind. This record enabled management and production to avoid production delays by keeping machines operating with fewer shutdowns for resharpening. The precision gears, 120 teeth/90 pitch, are made from 24 ga., ¼-hard brass. In heat treatment the die moved only .0005" on the maximum diameter of the gear.

It wasn't a happy coincidence that the tool and die steel was perfectly suited to put production from the tools on a smooth, trouble-free basis. It was planned that way—with the help of the Carpenter Matched Set Method. For the Method not only enabled this plant to eliminate costly experimentation in selecting the right steel, but enabled management to forecast output in advance because they could count on the tools to produce the parts *on time*.

Used in hundreds of plants, the Method offers far more than simplified tool steel selection. It makes machine operators more productive. It enables your plant to carry lower tool steel inventories. It makes heat treating easier, simplifies toolroom and production procedures. What's more, it is amazingly easy to apply. No extra cost or bother. To discover what it can do for you, ask for the new booklet "How to Get Better Tool and Die Performance". THE CARPENTER STEEL CO., 109 W. Bern St., Reading, Pa.

Export Department: The Carpenter Steel Co., Reading, Pa.—"CARSTEELCO"

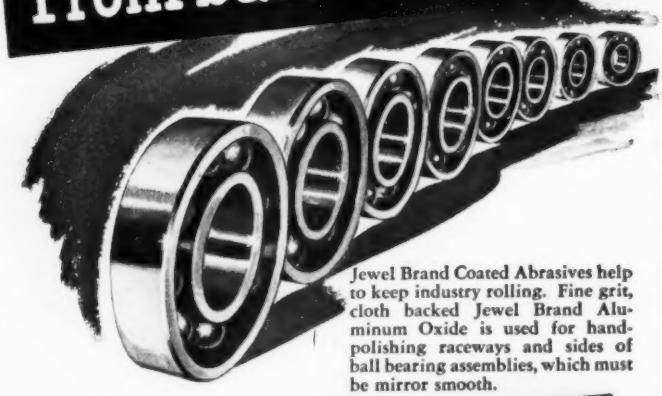
Carpenter

MATCHED TOOL & DIE STEELS

More than top-grade steels . . . a Method to keep tooling and production on schedule!

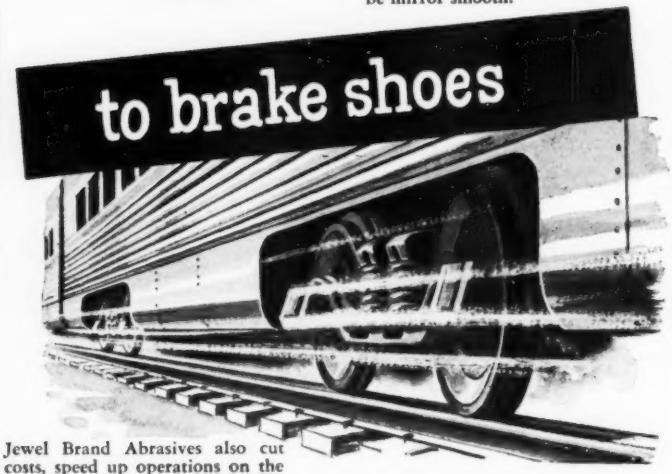
For your convenience, Carpenter carries warehouse stocks in principal cities throughout the country.

From ball bearings



Jewel Brand Coated Abrasives help to keep industry rolling. Fine grit, cloth backed Jewel Brand Aluminum Oxide is used for hand-polishing raceways and sides of ball bearing assemblies, which must be mirror smooth.

to brake shoes



Jewel Brand Abrasives also cut costs, speed up operations on the brake shoes that stop our trains. Fast-cutting, heat-resistant *Weldisks* permit faster grinding, safely! *Weldisks* will not curl or warp . . . are noted for their durability.

THERE'S A JEWEL BRAND COATED ABRASIVE to do every job, large or small, and to do that job *quicker, cleaner,* at *lower cost!* Ask your industrial distributor or write for catalog. Abrasive Products, Inc., 561 Pearl Street, South Braintree 85, Mass.

SHARPER, TOUGHER

Jewel COATED Abrasives

ABRASIVE PRODUCTS, INC. JEWEL ABRASIVES SOUTH BRAINTREE, MASS. U.S.A.

CUT COSTS!

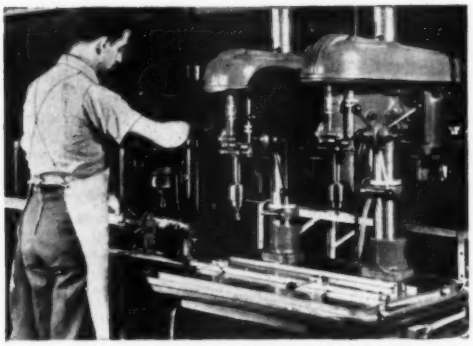
of employment. If the turnover of labor in a given plant proved to be excessive, that would be a matter for close investigation and if tackled promptly, intelligently, and with resolution, a remedy would surely be found. Careful examination of the headache would be sure to reveal the cause and, frequently, the cause suggests the remedy to be applied.

In spite of the fact that many reasons can be advanced for changing jobs, the chance to earn more money and the certainty of enjoying better working conditions stand high on the list. If the turnover is about normal, no special action is called for, since an occassional new face in the shop has been known to put a different, more attractive complexion on some existing shop methods. When that happens, the change is all to the good.

A current example, in the fitting section, impressed this truth on the writer's mind. Building special purpose machine tools was the firm's line, the new fitter was young and all his previous experience had been confined to high-class marine-engine work. An unusual bearing on some of the machines in progress was fitted with an end cover having a flange and long spigot, when the flange was bolted hard on to the end face of the bearing it was most important that the face of the spigot should stand off from the face of an inner ring by an amount not exceeding 0.010 in. Because of the small diameter of the bearing and the distance of the inner ring from the end face, a smallish hand could, with difficulty, test the 0.010-in. gap with feeler gages but much time was normally spent on this job.

The new fitter suggested the marine practice of "taking leads" as a means of speeding up and making matters easier for the fitter concerned. He demonstrated by laying a spot of petroleum jelly on three equally spaced places around the face of the spigot on the end cover, placed a short length of thin lead wire on each spot and slid the cover into place. The petroleum jelly held the lead wire in position till it made contact with the face of the inner ring and the cover was bolted hard home, squeezing and flattening the lead wire against the face of the inner ring. He then tried feeler gauges between the flange and the outer end face of the bearing, noting the reading, after which he withdrew the end cover and miked the leads. If the space between the flange and the outer end face measured 0.010 in. and the leads meas-

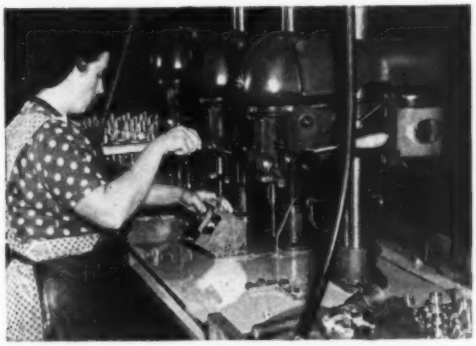
HOW Delta Tools Solved Four Unusual Production Problems



TIME SAVING 50%—PRODUCTION INCREASE 100%

ALBERT SPECIALTY CO., CHICAGO, ILLINOIS

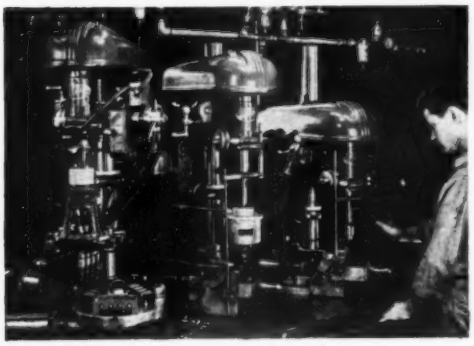
When lack of a 3-spindle drilling machine jeopardized vital sub-contracts on aircraft and signal corps equipment, this company combined a Delta 2-spindle unit and a Delta 1-spindle unit for drilling, countersinking and tapping six holes in each end of a tube used in a signal corps tripod. A special fixture made it possible to drill the phenolic tubing and brass casting simultaneously with different position limits to make tripods interchangeable. Result—a 50 per cent time saving and production increased 100 per cent over the old method.



ACCURATE HIGH SPEED DRILLING—NO SCRAP

OHIO BRASS CO., MANSFIELD, OHIO

To achieve precision accuracy at a cutting speed of 12000 rpm. in drilling and reaming forged aluminum blanks for fuse components, three Delta super high-speed drill presses were installed in sequence. Blanks are passed from one station to the next, and stops on the table make for quick accurate positioning. Scrap has been eliminated.



DRILL AND TAP 160 PIECES PER HOUR

EDWARD VALVES, INC., EAST CHICAGO, INDIANA

To increase production speed and reduce labor costs on valve stop collars, Edward Valves, Inc., installed three specially tooled Delta drill presses. Piece is put in machine at right and drilled, manually positioned but automatically clamped by air on drill downstroke. Center machine does tapping operation. Production rate—160 pieces per hour on both operations. Left machine drills valve lubricant screws with 5/32 drill, 500 pieces per hour, with 95% of operation actual machining time, only 5% for loading.

DRILL PHENOLIC PARTS WITH PRECISION ACCURACY

ACRO MANUFACTURING CO., COLUMBUS, OHIO

Delta Super-Hi speed drill presses solved three serious problems of drilling phenolic switch parts: (1) formerly drilled four switches to one bit—now drill 150; (2) enlarging holes close to edges of phenolic parts always resulted in 60% scrap because of breakage—with Delta scrap is only 10%; (3) drilling a .004 hole to tolerances of plus or minus .0005 formerly required two operations, drilling from either side. Now with Delta it is done from only one side.

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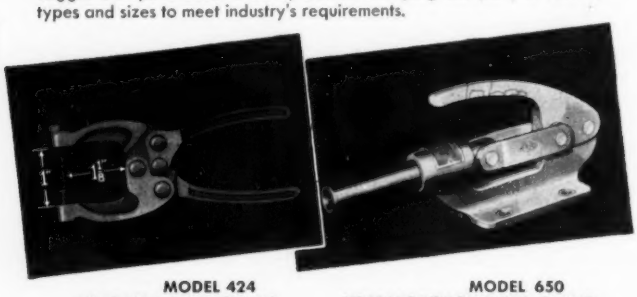

MODEL 424
PORTABLE PLIER CLAMP
For one-hand use in cramped work areas and small space. Deep jaw capacity but only 4½" in length.

MODEL 650
HEAVY DUTY PLUNGER CLAMP
For "push-pull" work-holding jobs where considerable pressure is needed. Compact; up to 4000 lbs. capacity.

MODEL 235-U RETRACTABLE CLAMP (Not illustrated)
Quick, unimpeded loading and unloading of fixtures easily possible with this one. Up to 750 lbs. pressure.

Ask for "DE-STA-CO" Toggle Clamp Catalog and name of representative nearest you who is stocking our entire line of Toggle Clamps.

DE-STA-CO **DETROIT STAMPING COMPANY**
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CITY ..... ZONE ..... STATE .....

ured 0.020 in. he knew that with the leads removed and the cover flange hard on the end face of the bearing, the space between the spigot and the inner ring would be the 0.010 in. called for. Much time was saved on the job by this infusion of the new blood in the shop. A trifle? Perhaps. But trifles make for perfection and perfection is no trifle.

If anything even remotely resembling mass exodus from a given plant takes place, the fault is most likely to be with management. Competition for labor, while a trying problem, is definitely not a hopeless one. As stated earlier, the most likely cause of frequent labor turnover is money and working conditions. If money, an incentive scheme should be formulated at once. In some plants that may be difficult but certainly not impossible, the difficulty of evolving an incentive scheme is only temporary but, if neglected, the drift away from the plant may become permanent. If the cause of the labor drift is found to be poor working conditions, the remedy is obvious. The important thing is to grapple with the problem before it assumes major proportions. It will usually be found that a remedy is not really difficult to apply when the cause has been laid bare.

C. D. MacKinnon
Airdrie, Lanarkshire, Scotland

•

"GET THE WORK OUT regardless of the other fellow's rights or interests," seems to be the battle cry of some people. When a foreman leaves one job to take another there is no reason why he should wreck the interests of the firm he is leaving by taking good men away with him or encouraging them to come to the new pasture after he himself is established.

There are many instances where the foreman has had a raw deal pulled on him and as a consequence he throws all ethics to the wind and proceeds to get even. One cannot blame him in such a case for being vengeful and neither can we sympathize with his former boss. In the event that the best of relations existed, the departing executive should refrain from employing any of his former men.

Does it reflect a weakness in a foreman when he can't step out into a new field without dragging along some of his best men? There's a great satisfaction in knowing your men and what they can do. The temptation to get them with you again is pretty hard to resist. Then

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with viewing screens

for table and spindle head settings

OUTSTANDING ADVANTAGES:

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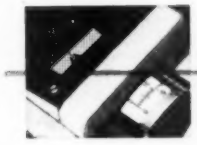
2. **Powerful spindle head** incorporating a self-contained drive and a spindle mounted at the nose in double taper roller bearings!
3. **Large free distances** between uprights and between table top and spindle end.



For Further Information
Send for our bulletin No. 1036a

SPECIFICATION

Working range	40 in. × 28 in.
Table working surface	43 1/4 in. × 33 in.
Maximum distance from table top to spindle end	35 1/2 in.
Free space between uprights	43 1/4 in.
Hydraulic feeds	from 12 in. to 100 in./min.
Spindle internal taper	Morse No. 4
18 speeds	from 40 to 2000 r.p.m.
Spindle quill travel	10 in.
Boring capacity	12 in.

Graduation of standard scales built into the work-table and the spindle head saddle		0.1 in.
Size of viewing screens		9/16 in. × 2 7/16 in.
Reading on external auxiliary scales		0.1 in.
Reading on screen micrometer drums	dial	0.001 in.
	vernier	0.0001 in.

Guaranteed setting accuracy: .00015in.

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HIGH PRECISION MACHINE TOOLS AND MEASURING EQUIPMENT

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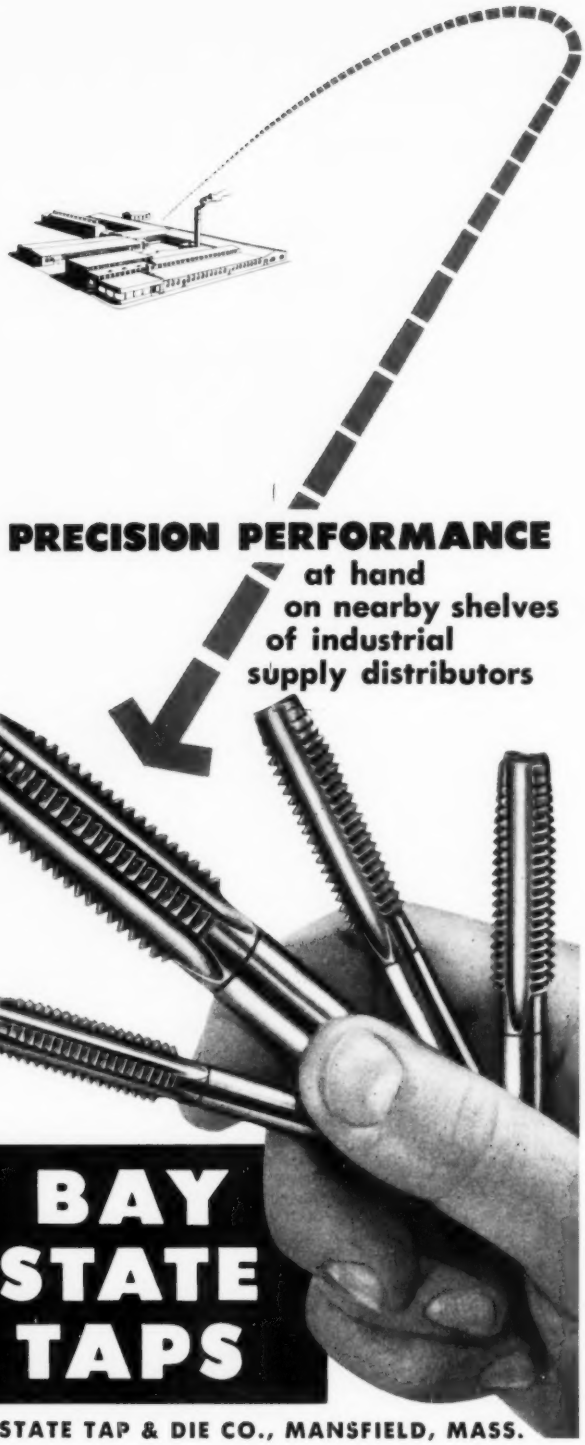


BAY STATE TAP & DIE CO., MANSFIELD, MASS.

again, there are greater opportunities for the men, in following in the wake of their old boss, which probably wouldn't exist if they remained on the job. Where to draw the line as to what constitutes fair play and what savors of dirty business practice is pretty hard to determine. The men themselves have the right to go where and when they please but it seems that some kind of restraint should be maintained so as to preclude the practice of deliberate stealing of skilled men. It is up to the employer to meet the challenge and up the ante when he sees one of his good men slipping through his fingers to take a better offer. That's one of the many privileges, or evils, of free enterprise.

Business is cold blooded and in order to survive it must grab at the last straw in order to keep up. Never will business succeed harmoniously, without occasional hard feelings, until the individuals are considerate of the other fellow's interests. Notwithstanding the gruesome implications I still say that it is not ethical to take skilled help away from another employer. We'll all have to admit, although it is a dirty trick, that it is darned convenient at times.

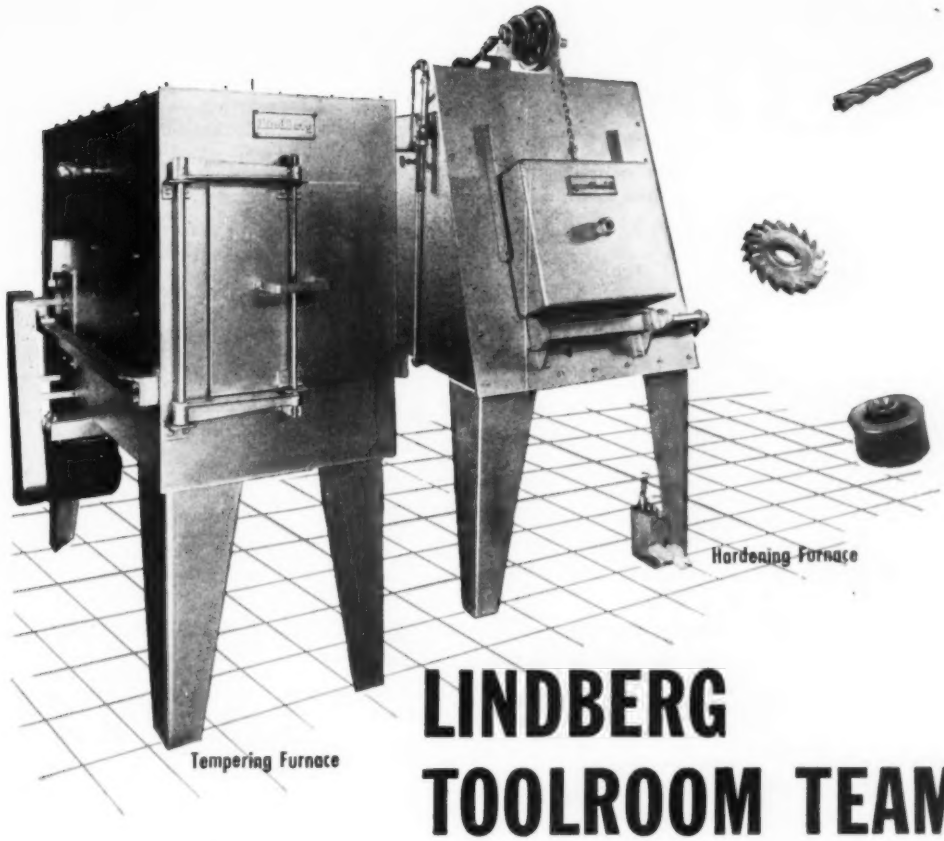
Jack Everett
Ontario, Calif.

•

TEA FOR TWO

IF WE could only see into the minds of the average group of workers, we would find fear, dislike, contempt and resentment. We would also find respect, loyalty, trust and a generally friendly feeling toward the foreman. This is the difference between a driver and a leader. The employee is governed by emotion, and the worker's emotions govern the amount of work he turns out. The good leader does not have to be easygoing, neither does he have to be hardboiled. He can be strict but definitely fair. He praises some good quality before finding fault. He has the ability to create in the employee an eager want. He respects good quality production, and makes the worker feel he is of some importance. The foreman is responsible for getting out production and holding down costs. He must have every worker on his team. He will not get it by driving but by leading.

When I was a young boy I worked for a foreman who never gave a direct order. He made sure we knew all there was to know about the job we were assigned to. He knew how to reprimand without antagonizing. He liked his cup of coffee at 10 o'clock in the morning and encour-



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Another in the Johnson line of dependable gas equipment has won its place in both large and small shops and plants. Operators like its easy adaptability. Six Johnson Direct Jet Bunsen Burners with individual shut off valves and pilot lights provide steady, easily controlled heat from 300 to 1850° F. Semi-muffled type with burners operating below Carbofrax hearth. Firebox: 7"x 13"x 16½". Also available bench style. Write for complete and factual information.

A smaller version of this highly flexible furnace is the No. 654. Four burners deliver 300 to 1800° F. Firebox: 5" x 7¾" x 13½". Available as pedestal or bench style.

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Johnson No. 706 Pedestal Style	$278.00
Bench Style	$250.00
Johnson No. 654 Pedestal Style	$150.00
Bench Style	$124.00

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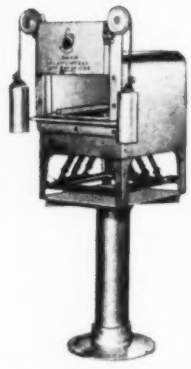

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Help PTC to "KEEP 'EM ROLLING"!

Every day thousands of Philadelphians depend on Philadelphia Transportation Company buses. To "keep 'em rolling," PTC's maintenance must be constant and thorough, since minor failures often cause major breakdowns.

For example, the hex nuts on bus rear axle flanges were being loosened by vibration, despite periodic inspections. Sheared studs resulted. Replacements were expensive, disrupted schedules and loss of riders' goodwill even more so. PTC tried FLEXLOC Self-Locking Nuts, found them a simple, economical solution to the problem.

FLEXLOCs stayed *tight*, eliminated shearing of studs. Yet FLEXLOCs were easy to remove when necessary, could be re-used again and again. Furthermore, FLEXLOC *dependability* reduced the number of maintenance checks needed, effecting additional savings.

If you have to contend with vibration in your business, try FLEXLOC Self-Locking Nuts—free! Just tell us the size, and we'll gladly send samples.

SPS STANDARD PRESSED STEEL CO.
JENKINTOWN 1, PENNSYLVANIA

aged us to do the same. He aroused in us a desire to want to work. What we liked most about this foreman was—he would stand back of any one of us if he thought we were right. It did not take him 13 minutes to drink his coffee and we followed his lead. I have never forgotten this foreman or his ability to handle people. I tried to follow the good example of the fundamental principles of human relations practiced by this foreman. In the final analysis men have been drinking coffee as long as I can remember during working hours. It is reasonable and decent treatment.

A. E. Salmons
Philadelphia

NEW BOOKS

INTRODUCTION TO HEAT TRANSFER (2ND EDITION)—*Aubry I. Brown and Salvatore M. Marco. Published by McGraw-Hill Book Co. 330 West 42nd St. New York. 267 pages. Price $4.50.*

Engineering students have employed this book as a standard text for almost ten years. Recent developments, and the appearance of new data on the thermal conductivity and viscosity of air and other gases have now made it desirable to carry out considerable revision.

The character and level remain unchanged, but revisions have been made in the material on estimating heat conduction by the mapping method; new material has been added on conduction and radiation; and the information on fluid flow has been considerably expanded.

Nomenclature has been revised to conform to current standards, a table of conversion factors has been added, and the graphs of physical properties revised to show recent data. The number of problems for student work has been more than doubled.

•

SIMPLIFIED MECHANICS AND STRENGTH OF MATERIALS—*By Harry Parker, Professor of Architectural Construction, University of Pennsylvania. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. 269 pages. Price $4.00. Size—8 by 5¼ in.*

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STYLE BRC (right) STYLE FRC (right) STYLE GRC (right)

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ROTARY FILES
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QUICK CHANGE CHUCKS and COLLETS

THE CHARLES L. JARVIS CO., MIDDLETOWN IN CONNECTICUT

tion, this handbook-size text should be valuable. Written with simplicity in mind, it includes basic information and examples on forces, moments, stresses, and materials. The author has avoided the use of higher mathematics, so anyone who can handle arithmetic and simple algebra should have no trouble with the text matter.

Although much of the information on materials tends toward architectural items, the sections on mechanics are general. Illustrations are good, and many useful tables are included.

•

THE STRANGE CASE OF THE SEVEN-SIDED POST HOLE—*Drawings by Tom Ross. Published by American Standards Association, Inc., 70 E. 45th St., New York 17, N. Y. 40 pages. Free upon request.*

This is the story of how Digby Holeston Postlethwaite (the Grand Old Man of the post-hole industry) helped to form the Association of Post Hole Manufacturers and Fabricators, Inc., and to establish the American Standard Specifications for Lap-Welded, Butt-Welded, and Seamless Post Holes (six-sided).

It's a whimsical tale with a moral; and points out why standards are good; how they can be established; how they can simplify, speed, and protect production; and how they help to keep industry free from governmental controls.

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CARBIDE CUTTING TOOLS. *By Warren Baker, M.S. and Joseph S. Kozacka, B.M.E., M.S. Published by the American Technical Society, 848 East 58th St., Chicago 37, Ill. 416 pages. Price $5.50.*

Here is a book that removes the veil of technical research and furnishes practical information on carbide tools to students, designers and engineers. There are 17 chapters, covering the development of tools since the beginning of their history to the eventual conversion to carbides. It offers complete information about carbides and cutting problems gathered from a wide variety of sources.

The book was sponsored by Vascoloy-Ramet Corp., and a special study guide has been prepared for this company by ATS. It is particularly useful for training shop personnel, as well as for individual study. The guide may be obtained free with a copy of Carbide Cutting Tools, if ordered from Vascoloy-Ramet Corp., Educational Training Dept., 800 Market St., Waukegan, Ill.

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT: Calol Cutting Oil 20-TA

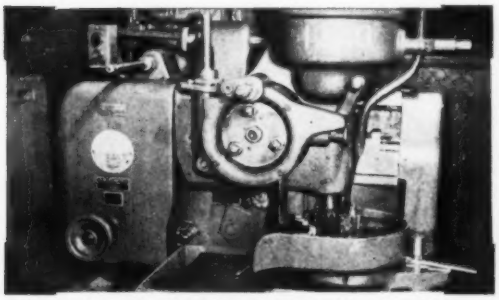
TOOL: High-speed gear shaper + others

LUBRICATOR: Circulating and hand

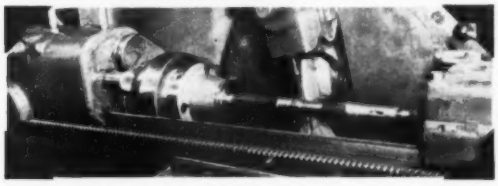
SERVICE: Making fuel-burner and engine parts

FIRM: Iron Fireman Mfg. Co., Portland, Oregon

Calol cutting oil triples machine-tool life!



THIS HIGH-SPEED GEAR SHAPER, in the big Iron Fireman Manufacturing Co. shop at Portland, Oregon, required a new cutting tool every half day until Calol Cutting Oil 20-TA replaced the comparable type competitive lubricant being used. Now tools on the machine are only changed after 1½ days of use. "Besides three times longer tool life, I get good surface finish at high speeds with Calol Cutting Oil, and it costs me far less than the oil I was using," says Bill Huntley, Maintenance Foreman.



CALOL CUTTING OILS are used in all the many machining operations in Iron Fireman's shop. This includes thread grinding (shown here), shaping, hobbing, drilling, turning and broaching. There is a complete line of Calol Cutting and Soluble Oils to meet every machining condition. They come in four general types: Mineral oils, ready-mixed compounded oils, concentrates and soluble oils.

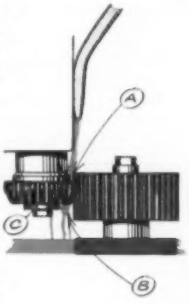
How to increase efficiency in all metal-cutting operations

Use the correct Calol Cutting Fluid for any operation from grinding to broaching. Recommendations for each are made from actual working results.

A. Have high cooling and lubricating qualities—minimize "built-up edge" and promote good finish.

B. Flush away cuttings readily.

C. Protect machine and work against rusting and corrosion.



FREE CATALOG: "How to Save Money on Marine Equipment Operation," a new booklet full of valuable information, is ready for you. Write or ask for your free copy today.

CALOL

TRADEMARK "CALOL" REG. U.S. PAT. OFF

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

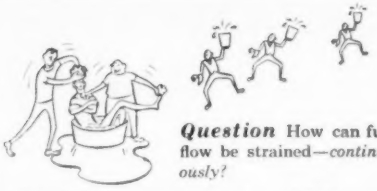
STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 861 • El Paso, Texas

There's just 1 answer

to all these questions about designing for clean fluid



Question How can full flow be strained—*continuously?*

Answer Cuno AUTO-KLEAN cleans full flow continuously because it can be cleaned, itself—periodically by hand or continuously by automatic means—*without stopping flow.*

Question How can I accommodate a straining device in *small* space?

Answer Cuno AUTO-KLEAN takes up minimum space per gallon—single unit occupies no more space than usual partial-flow type.

Question How can I adapt one design of strainer to *any* installation?

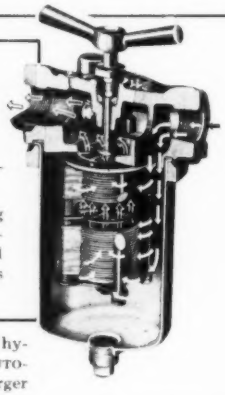
Answer Cuno AUTO-KLEAN can be supplied for built-in or external mounting . . . in any position of inlet and outlet . . . a few or more than 4000 gpm.

Question How can pressure drop be kept *low?*

Answer Cuno AUTO-KLEAN causes minimum pressure drop—can be installed on low pressure or gravity feed or suction with no loss of efficiency.

Question How can I relieve user of *replacement* costs?

Answer Cuno AUTO-KLEAN will last as long as the equipment on which it is installed because it is all-metal and non-collapsible and can be made of proper materials for various fluids, viscosities, temperatures and solids.



For general services, particularly lube and hydraulic systems, specify compact Cuno AUTO-KLEAN, guaranteed to remove all particles larger than specified.*

No Fluid Is Better Than Its Filtration

CUNO

Complete Line

Fluid Conditioning

Removes More Sizes of Solids from More Types of Fluids

MICRONIC (Micro-Klean) • DISC-TYPE (Auto-Klean)
WIRE-WOUND (Flo-Klean)

**Models available for straining from .0035 to .062 in.*

Find Out How AUTO-KLEAN Can Solve Your Fluid-Cleaning Problems

- ☐ Air Actuated Instruments
- ☐ Air Tools
- ☐ Bakery Machinery
- ☐ Balers
- ☐ Blowers
- ☐ Boiler Feed
- ☐ Coal Loaders
- ☐ Coating Machinery
- ☐ Combustion Equipment
- ☐ Compressors
- ☐ Controls
- ☐ Cooling Systems
- ☐ Crushers
- ☐ Diesel Engines
- ☐ Dip Tank Systems
- ☐ Drilling Machines
- ☐ Engines
- ☐ Gear Hobbing Machines
- ☐ Grinders
- ☐ Hobbing Machines
- ☐ Honing Machines
- ☐ Hydraulic Systems
- ☐ Incubators
- ☐ Instruments
- ☐ Lathes
- ☐ Lubricating Systems
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- ☐ Rolling Mills
- ☐ Scrap Balers
- ☐ Spray Systems
- ☐ Superchargers
- ☐ Tapping Machines
- ☐ Test Stands
- ☐ Turbines
- ☐ Turret Lathes
- ☐ Welding Machines

OTHERS _____

MAIL THIS COUPON

CUNO ENGINEERING CORPORATION
241 South Vine Street, Meriden, Conn.

Please send me a free copy of your AUTO-KLEAN bulletin. I am especially interested in the services checked.

Name ..... Title .....

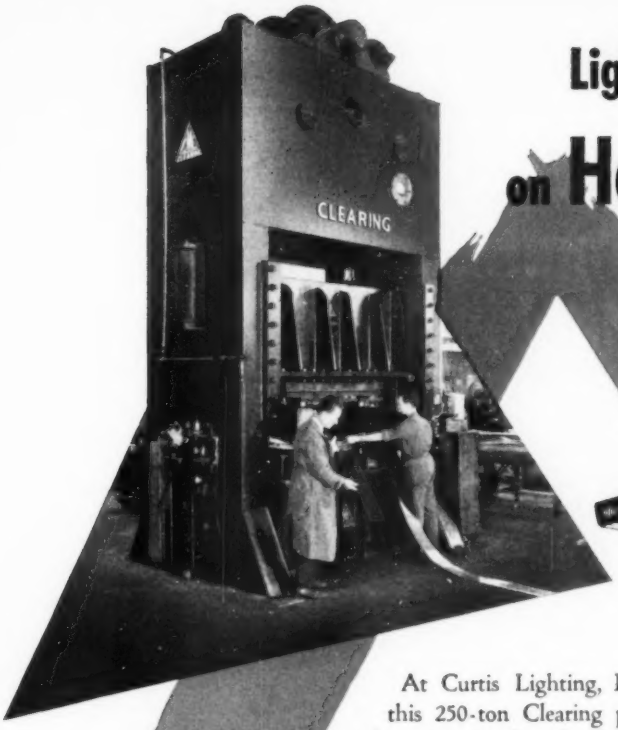
Company .....

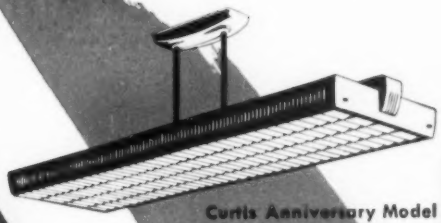
Address .....

City ..... State .....

PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

Light Production Costs on Heavy Volume of Light Fixtures





Curtis Anniversary Model 51-CLH

At Curtis Lighting, Inc., Chicago, this 250-ton Clearing press produces louvers up to four feet long for fluorescent lighting fixtures. It hasn't been out of service a single minute in three years of steady two-shift operation. With two men working the three station dies, the press blanks, perforates and forms 68 complete louvers per hour.

Steady, top tempo production without interruption is the secret of real economy, and Curtis Lighting, Inc., chose Clearing because they knew it was the way to hold down costs. With something like 12,000 service hours delivered and the first minute of press down-time still uncharged, it seems they made a wise choice.

If you want that kind of production economy in your plant, get in touch with Clearing.

CLEARING MACHINE CORPORATION

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CMC CLEARING

CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

PROVED READERSHIP

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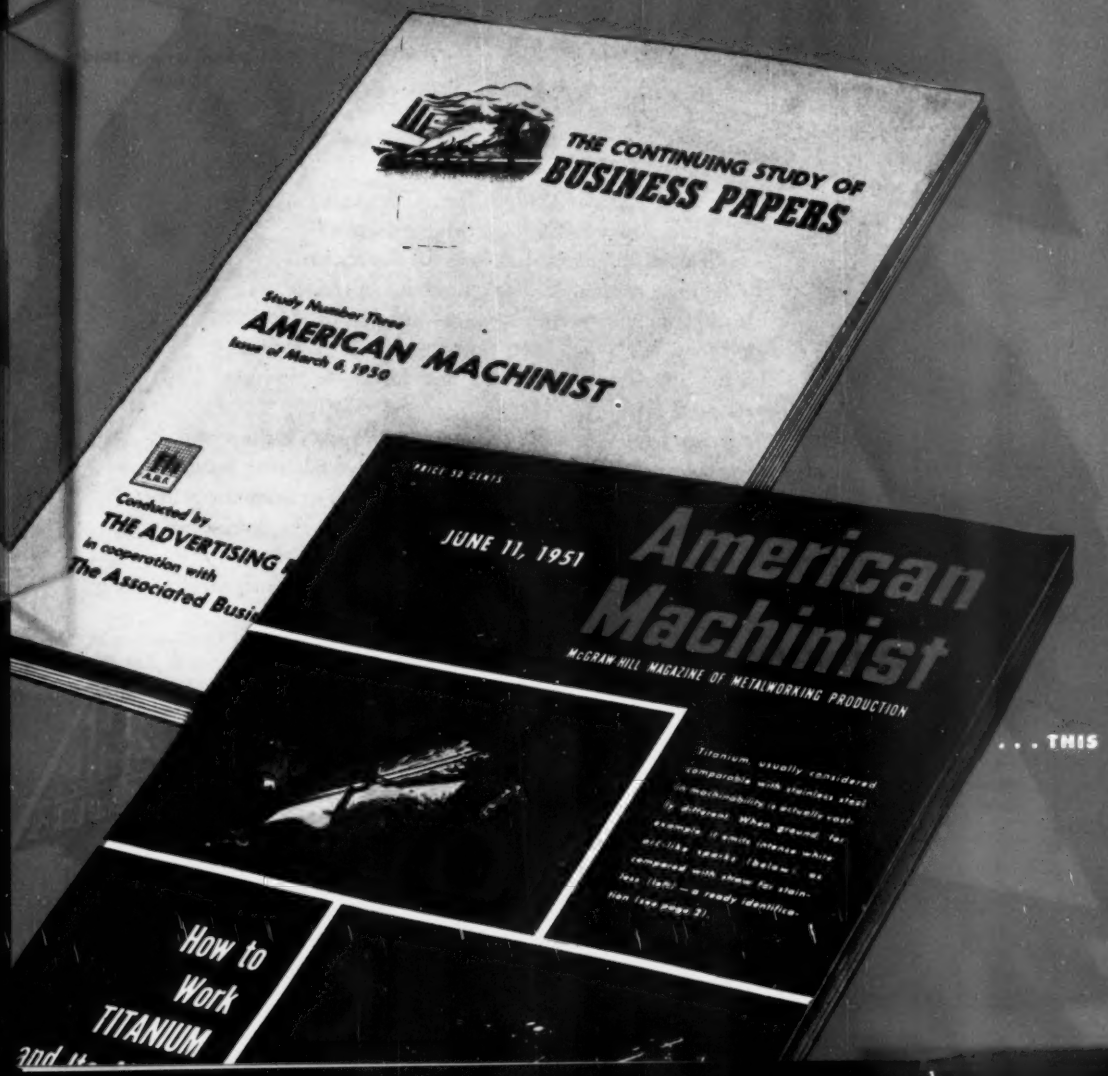


. . . THIS

world's great selling forces*

If you sell to America's industrial giant . . . Metalworking . . . and want certain PROOF of advertising value before you buy space in a metalworking magazine . . . this fact is important to you:

American Machinist offers you the certain, completely reliable proof you will find in the *only* Advertising Research Foundation Study of a metalworking magazine.

Conducted, tabulated, analyzed, and produced by the only media research organization founded, controlled, and operated by national advertisers . . . members of the AAAA and ANA . . . this study gives you the kind of dependable facts you've long wanted as a guidepost in media selection.

It also gives you exciting evidence of why . . . in selling to America's biggest industrial market . . . advertisers invest more advertising dollars in *American Machinist* than are invested in any other metalworking magazine. It gives you PROOF of intent, cover-to-cover readership by 28,000 metalworking men with real buying power in this $100-billion-a-year manufacturing industry. Copies of this study are available to you through your nearest *American Machinist* representative.

The facts will tell you: when you want to do more business with America's basic industry . . . *concentrate your advertising in American Machinist.* Don't buy less . . . when only *American Machinist* offers you the proved readership of 28,000 management-concentrated, production-minded, metalworking men.

Before you advertise in any other metalworking magazine . . . make sure a full schedule in *American Machinist* is selling this giant industry's production executives for you . . . with peak impact and at low cost.

In 1950 American Machinist was first in advertising pages among all magazines of less than weekly frequency . . . fourth among all magazines.

DISTRICT OFFICES: Atlanta 3, Boston 16, Chicago 11, Cincinnati 8, Cleveland 15, Dallas 1, Detroit 26, Los Angeles 14, New York 18, Philadelphia 3, Pittsburgh 22, San Francisco 4.

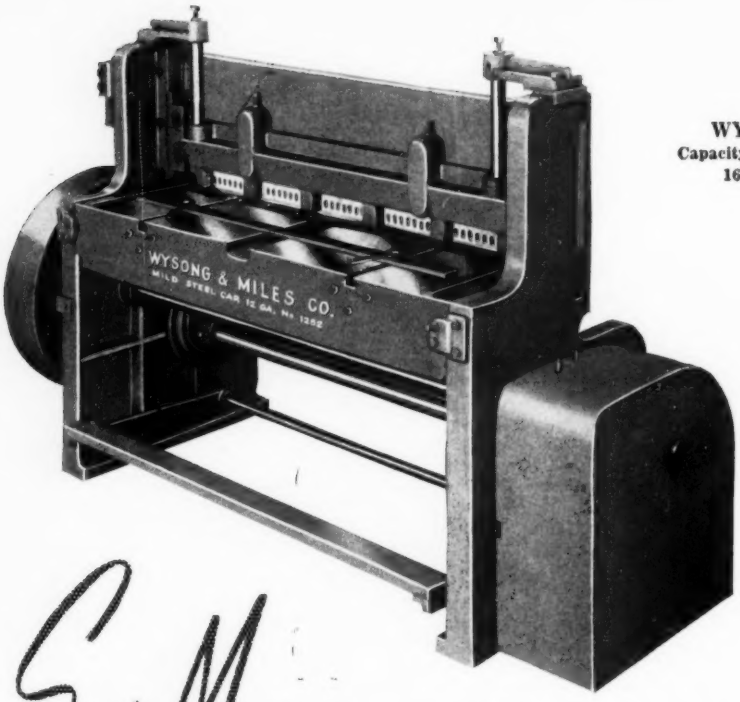
IS A GOOD PLACE TO DO BUSINESS WITH AMERICA'S BIGGEST INDUSTRY

THE McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

ABP ABC

Member of Associated Business Publications and Audit Bureau of Circulations

McGraw-Hill Building, New York 18, N. Y.



WYSONG No. 1252
Capacity: 52", 12 ga., mild steel. 16 ga., stainless steel.

Save Money WITH WYSONG'S 12 GAUGE SERIES

If most of the sheets you shear are 12 gauge or less, you now can get an economical 12 gauge shear to meet your requirements.

To insure top performance at a 12 gauge rating, Wysong 12 gauge series are all tested at the factory on *10 gauge* sheets. Made in 52-inch, 6 foot, 8 foot and 10 foot cutting lengths, one of these economical shears meets the full shearing requirements of most sheet metal shops.

STANDARD EQUIPMENT INCLUDES . . . Motor with controls and electrical equipment; ball bearing, precision Back-Gauge; embedded, adjustable, stainless steel Scale; slotted metal Finger Guard; Non-Repeat Unit; and 4-edge Blades.

Rigid Wysong *Hi-Tensile* Casting construction is combined with time saving features to give speed and accuracy in operation, plus many years of satisfactory service.

Each Wysong shear is tested for 24-hours of operation before leaving the factory and is shipped *completely equipped* and ready for continuous operation.

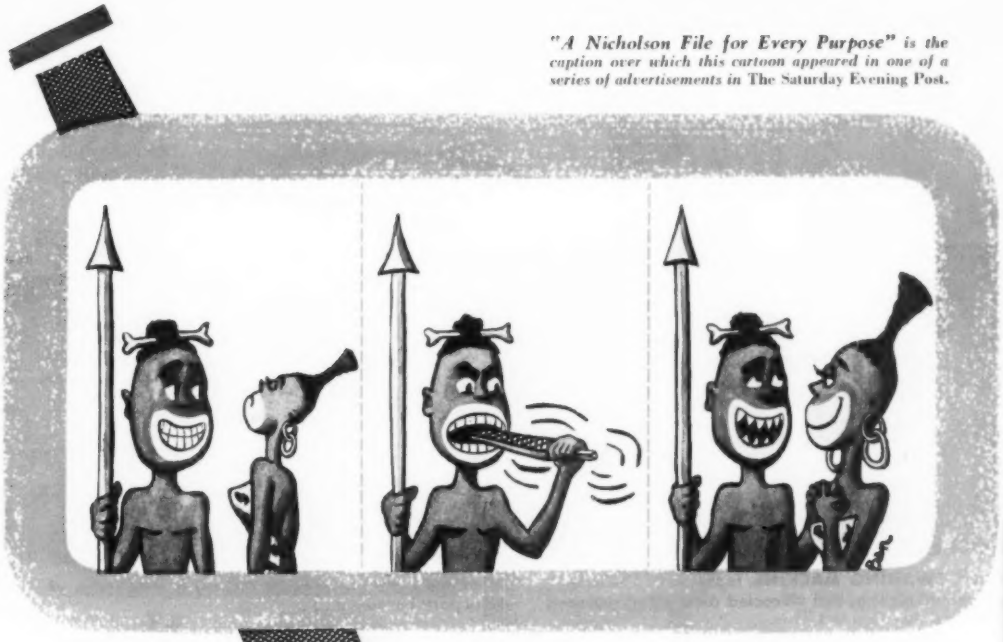
THE WYSONG 12 GAUGE SERIES

No. 1252 . . . 52 inch cutting length
No. 1272 . . . 6 feet cutting length
No. 1296 . . . 8 feet cutting length
No. 1210 . . . 10 feet cutting length

Wysong builds a complete line of Air, Foot and Motor powered squaring shears for the Sheet Metal Shop. See your dealer or write for Catalog No. 44.

WYSONG and MILES Co.
GREENSBORO, NORTH CAROLINA

"A Nicholson File for Every Purpose" is the caption over which this cartoon appeared in one of a series of advertisements in The Saturday Evening Post.



The right teeth make a big difference

Enlarged "horizon" (cross section) of the teeth of a typical Nicholson file.

How to select, use and care for *The right file for the job* is interestingly described with words and pictures in Nicholson's famous 48-page book, "FILE FILOSOPHY." FREE . . . send for as many copies as you can judiciously place in the hands of your key production and purchasing personnel.

Proper design, even height, uniform sharpness and correct hardening of teeth are tremendously important in lengthening the life and increasing the efficiency of files. Such qualities take on added significance as defense preparedness calls for production speed-ups, steel conservations and maximum tool wear. They are "naturals" in Nicholson products.

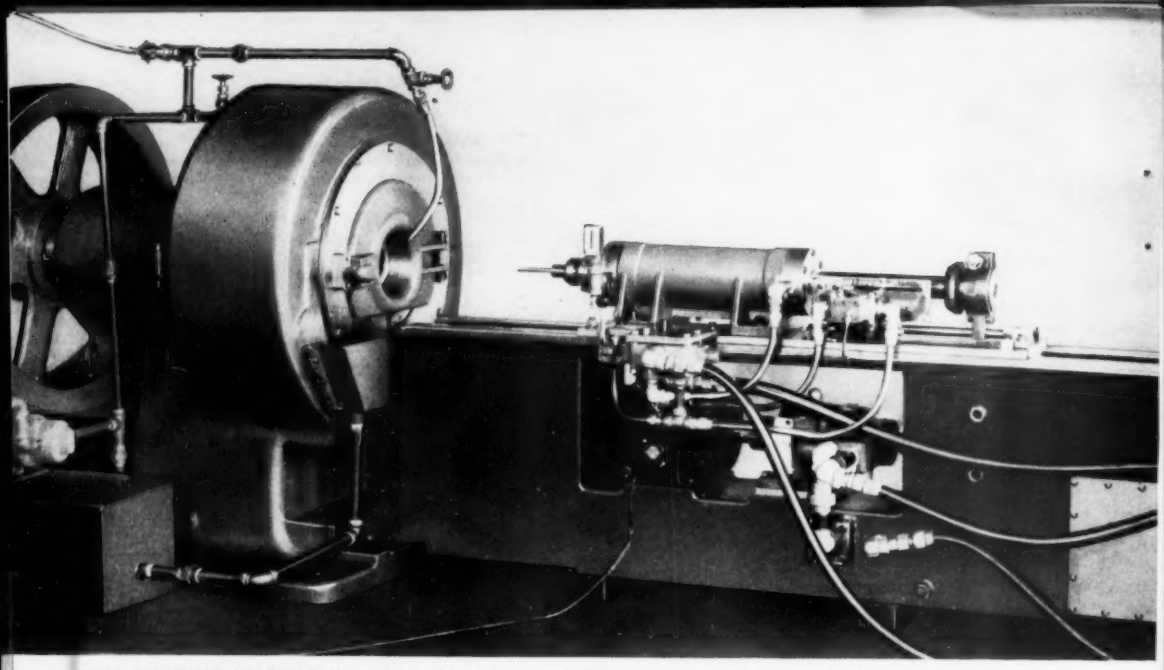
Nicholson file manufacture has *always* given uppermost thought to the designing, cutting and heat-treating of the myriads of tiny teeth which constitute the vital "business ends" of one of industry's most indispensable hand tools.

Thus, it can be said that Nicholson and Black Diamond files "speak through their teeth." And what they say is, "*Twelve perfect files in every dozen*—made from top-quality file steel and 87 years' experience."

Sold through industrial distributors throughout the world.

NICHOLSON
A FILE FOR EVERY PURPOSE

NICHOLSON FILE CO. • 29 ACORN STREET • PROVIDENCE 1, RHODE ISLAND
(In Canada, Port Hope, Ont.)



FENN SWAGING MACHINE, featuring hydraulic feed, automatic chucking, and oil-cooled dies, is fast replacing lathes and screw machines for shaping a wide range of metal parts because it . . .

MAKES METAL GO TWICE AS FAR

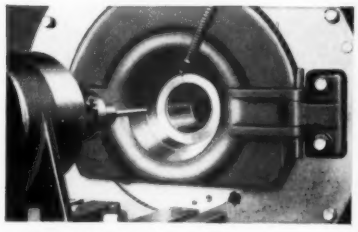
Yes, you can cut your metal requirements in half, in many cases, with this Fenn Swaging Machine. That's because it doubles the length of the blanks it shapes . . . with absolutely no stock removal.

MANY OTHER ADVANTAGES

What's more, this Fenn Swager produces a denser structure in metal parts . . . maintains concentricity . . . gives an improved finish . . . requiring no subsequent grinding . . . calls for less operator skill than any other machine capable of producing equivalent parts.

WRITE FOR SPECIFICATIONS

It will pay you to investigate all the cost-cutting, material-saving advantages of the Fenn Swager. Contact the Fenn distributor nearest you for facts and delivery schedules, or write direct to THE FENN MANUFACTURING COMPANY, 1859 Broad St., Hartford 1, Conn.



SIMPLE DIE CHANGES, using blanks in various diameters, make Fenn Swaging Machines quickly and easily adaptable to a wide variety of jobs. You can use them for reducing, pointing, or forming bar stock or tubing. Also for assembling fittings to cables. Fenn Swagers and Hydro-Formers come in sizes and designs for every swaging need.

FENN

Shaping metal for better and stronger products at lower cost

FENN MACHINES ARE SOLD BY:

ATLANTA
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CLEVELAND
Wm. K. Stamets Co.
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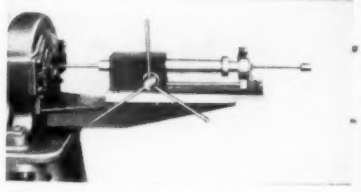
Indianapolis Machinery Export Co., Inc., New York, N. Y.



FENN FEEDING DEVICES, either manually or hydraulically operated, are available for all sizes of swagers. They speed up production and reduce operator fatigue.

REMOVE CHIPS... THE Hapman WAY

★ AUTOMATIC
★ ECONOMICAL
★ CLEANER

Hapman
TUBULAR CONVEYORS
WILL HANDLE CHIPS • SLUDGE WELDING FLUX • DUST

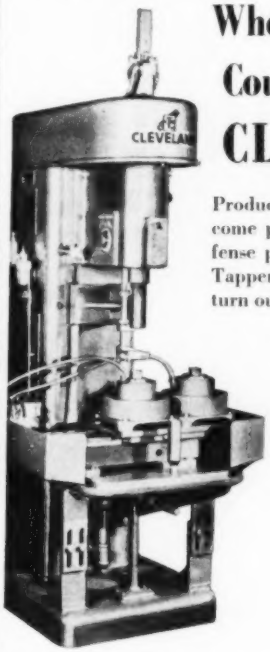
Any flowable material—from abrasive dusts to food materials—can be handled with maximum efficiency in a Hapman tubular, rubber flight, sealed pin conveyor. One of the many applications where Hapman Conveyors are doing a *better* job of waste removal is the illustration above—as an integral part of a Footburt horizontal broach, chips are removed continuously.

Hapman Conveyors operate in any plane and at any angle, and require a minimum of clearance and support. Exclusive Hapman construction features assure long life, low maintenance and low operating cost.

A Hapman job-engineered Conveyor system will solve almost any flowable material handling problem. Write today for catalog showing details of construction and applications.

Hapman CONVEYORS, INC.
DIVISION HAPMAN-DUTTON COMPANY
KALAMAZOO MICHIGAN

CLEVELAND tapping machines lead screw



When Every Hour Counts...Rely on CLEVELAND

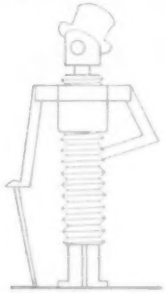
Production hours saved can become pretty important in a defense program...and Cleveland Tappers save production time... turn out more perfect pieces per hour. They cut tapping costs by combining operations...turn semi-skilled workers into skilled operators. Cleveland engineers can design a machine for your needs which will not only combine several operations but also tap groups of holes at one stroke of the machine. If you have a production problem check with Cleveland FIRST.

A CLEVELAND TAPPER set up on a munitions job, tapping a 1 15/32". 16-pitch Buttress thread in SAE 4143 steel tubing hardened to 35 to 37 Rockwell.

Cleveland offers all these features

- Precision hardened and ground lead screw.
- Fully automatic or manual control.
- Precision depth control for blind hole tapping.
- Heat treated alloy steel spindles for maximum strength.
- Easily changed spindle speeds.
- Exclusive super sensitive clutch reduces breakage and increases tap life.
- Positive coolant and lubricant supply under constant control of operator.
- Rigidly constructed to give years of service.
- Maximum safety for operator and machine.

Meet Mr. Lead Screw



of The Cleveland Tapping Machine Co. Mr. Lead Screw symbolizes the time-proved lead screw feed designed and pioneered by Cleveland . . . now generally accepted as the key to precision tapping at high speeds. Write for your copy of the Cleveland Production Tapping Guide and a copy of Catalog AM-4.

THE CLEVELAND TAPPING MACHINE CO.
A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC. CANTON-8, OHIO

reduce assembling and maintenance time

If your production line, or plant maintenance calls for nut application or removal you'll find just the right wrench in the CP line of reversible air impact wrenches.

Powerful, compact, perfectly balanced, and with no twisting thrust to fatigue the operator, CP wrenches speed operations and cut costs.

Capacities range from $\frac{1}{4}$" to $1\frac{3}{4}$" bolt size, and angle head models are available to reach awkwardly located nuts, bolts and studs. Power regulators, for control of tightness, are available on all models up to $\frac{3}{4}$" bolt size.

Write for a copy of Bulletin 812

CAPACITIES—BOLT SIZE

CP-337	$\frac{1}{4}$"
CP-344	$\frac{3}{8}$"
CP-3440	$\frac{3}{8}$", heavy duty
CP-349	$\frac{5}{8}$"
CP-360	$\frac{3}{4}$"
CP-3630	$\frac{3}{4}$", heavy duty
CP-365	$1\frac{1}{4}$"
CP-375	$1\frac{3}{4}$"

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

COSTS DOWN 25%
PRODUCTION UP 100%

WHEN STRESSPROOF® REPLACED HEAT-TREATED .40 CARBON ALLOY STEL BARS

- *Speeded Machining 50% to 100%*
- *Eliminated need for Heat Treated Alloy Bars*

This thickness control screw, made from STRESSPROOF steel bar, is a vital part of the asphalt road layer shown laying an air strip at a Pacific base.

In this asphalt road layer, instead of using a heat-treated, hot-rolled .40 carbon alloy bar, STRESSPROOF was specified. STRESSPROOF provided in the bar the necessary strength and wear resistance, and machined so much easier that production time was cut in half.

STRESSPROOF's unique combination of four important qualities is the key to cutting costs and speeding production on many similar defense jobs. STRESSPROOF is twice as strong as ordinary cold-finished bars. Its resistance to wear often makes carburizing unnecessary. It is machined so easily to minimize distortion, and has machinability rating fully 50% better than heat-treated alloys of the same hardness. Yet STRESSPROOF is less expensive than all cold-finished and most hot-rolled alloy steel bars that have been fully heat treated.

STRESSPROOF is also available with a Ground and Polished Finish.

LASALLE STEEL CO.
1416 150th Street, Hammond, Indiana
Manufacturers of the Most Complete Line of Cold Finished and Ground and Polished Bars in America

La Salle
STRESSPROOF®

SEVERELY COLD-FORMED, FURNACE-TREATED CARBON STEEL BARS

STRESSPROOF IS PLAYING A VITAL ROLE IN NATIONAL DEFENSE!

A very large proportion of STRESSPROOF production, today, is going into defense jobs. However, from time to time sample bars may be available for testing purposes.

Across the country — in less than a minute!

Some day soon, a jet plane will leave New York at 9 A.M. . . .

And be in California—at 9 A.M.!

So fast are modern jets, they come close to following the sun in its flight across the continent. Speed? Yes. But in manufacture, the story is different!

The all-precision jet engine takes almost *four* times as much machining as World War II aircraft. It's long work—but defense deadlines are short!

To speed up jet assembly lines, the plane-makers have learned amazing production tricks. And they've learned an amazing traffic trick, too.

When ordering and shipping parts, the makers of the world's fastest planes use the world's fastest service—Air Express!

Whether your business is jets or jewelry, here are the unique advantages you can enjoy with regular use of Air Express:

IT'S FASTEST—Air Express gives the fastest, most complete door-to-door pick up and delivery service in all cities and principal towns, *at no extra cost.*

IT'S MORE CONVENIENT—One call to Air Express Division of the Railway Express Agency arranges everything.

IT'S DEPENDABLE—Air Express provides one-carrier responsibility all the way and gets a *receipt upon delivery.*

IT'S PROFITABLE—Air Express expands profit-making opportunities in distribution and merchandising.

For more facts call Air Express Division of Railway Express Agency.

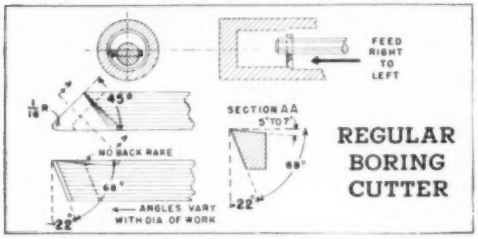
AIR EXPRESS

GETS THERE FIRST

Memo to mechanics

How to do it right with WILLIAMS BORING TOOLS

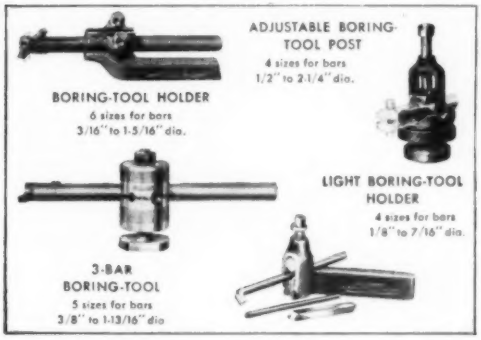
Boring Tools of this type, as opposed to drills and reamers, are used for machining internal surfaces and their operation might be described as *inside* turning. The cutters differ from outside turning tools in that they must be ground with more front clearance to prevent the heel of the tool from rubbing. Recommended grinding angles and proper application of tools to work are graphically explained in the three diagrams.

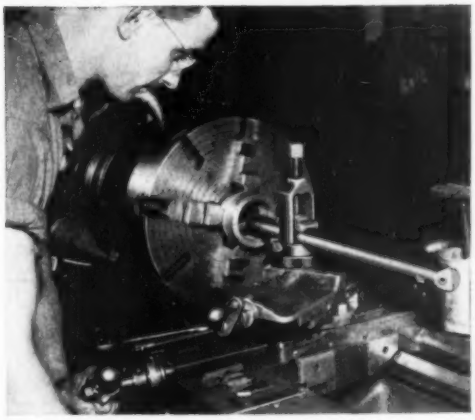


Above Cutter used with Williams Boring-Tool Posts, Holders and 3-Bar Boring-Tools

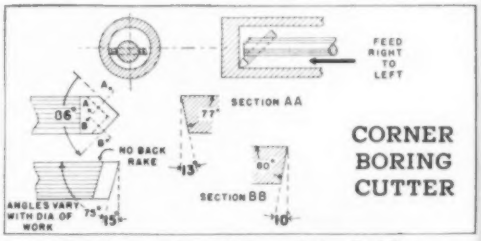
There are four types of Williams Boring Tools as illustrated below. Bars and Cutters are interchangeable in all except the Light Boring-Tool Holder. Depth of hole, of course, determines the length of bar required. When using long bars, remember that the increased overhang makes the tool more likely to spring and correspondingly lighter cuts should be taken.

Copies of this and other "Memos to Mechanics" are available free upon request.

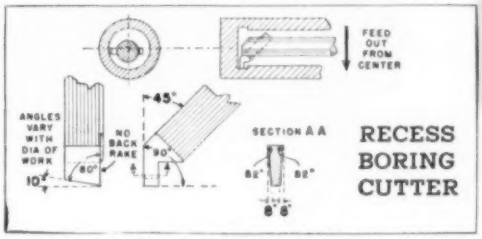

ADJUSTABLE BORING-TOOL POST
4 sizes for bars 1/2" to 2 1/4" dia.
BORING-TOOL HOLDER
6 sizes for bars 3/16" to 1 5/16" dia.
LIGHT BORING-TOOL HOLDER
4 sizes for bars 1/8" to 7/16" dia.
3-BAR BORING-TOOL
5 sizes for bars 3/8" to 1 13/16" dia



Height of bars is easily adjusted with this Williams Boring-Tool Post



Above Cutter used with Williams Boring-Tool Posts, Holders and 3-Bar Boring-Tools



Above Cutter used with Williams Boring Tool Posts, Holders and 3-Bar Boring-Tools

OPEN END, BOX, ADJUSTABLE & RATCHET WRENCHES; DETACHABLE SOCKETS & SETS; IMPACT SOCKETS; TOOL HOLDERS; LATHE DOGS; "C" CLAMPS; CHAIN PIPE TONGS & VISES; FLANGE JACKS; PLIERS; SCREWDRIVERS; PUNCHES & CHISELS; SOFT FACED HAMMERS; HOIST HOOKS; EYE BOLTS; ROD ENDS; CRANK & BALANCE HANDLES; THUMB SCREWS & NUTS; BODY & FENDER TOOLS.

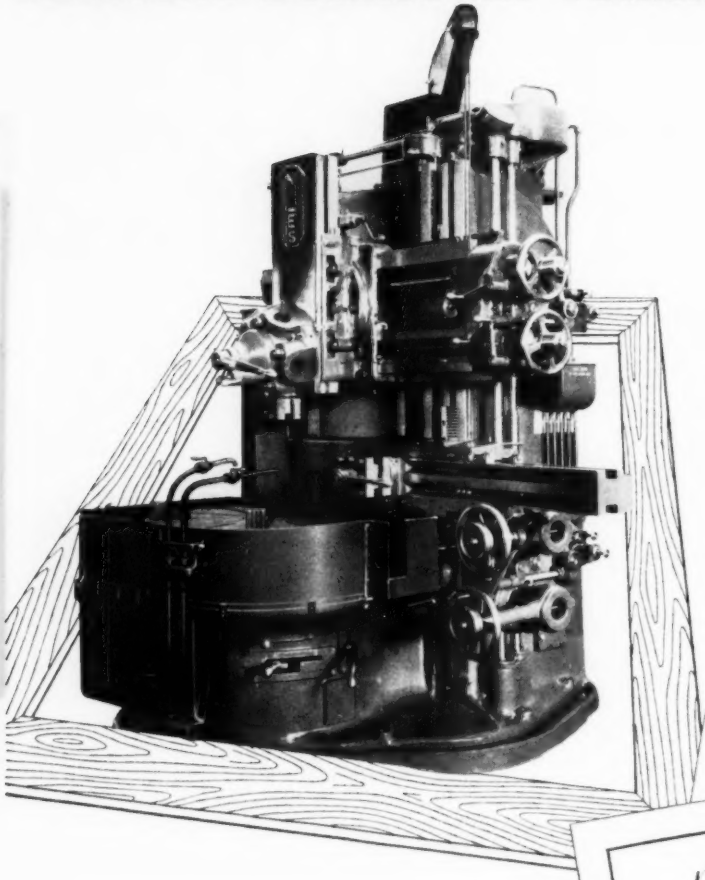
WILLIAMS

• OUR DISTRIBUTOR IS YOUR LOCAL WAREHOUSE

J. H. WILLIAMS & CO., BUFFALO 7, N. Y. *Distributors Everywhere*

Announcing

THE NILES 42" SIDE HEAD VERTICAL BORING AND TURNING MILL



- Combines advantages of horizontal turret lathe, engine lathe and vertical turning and boring mill . . . *plus!*
- Center stop accurately locates rail-head and maintains perfect alignment with center line of table spindle.
- Cross rail guide assures perfect alignment between cross rail and table in all positions of cross rail.
- Simplified and convenient controls.
- Designed for *fast set-ups.*
- Spiral bevel gear drive.
- Anti-friction radial and thrust bearings.

R. S. V. P.

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BALDWIN-LIMA-HAMILTON

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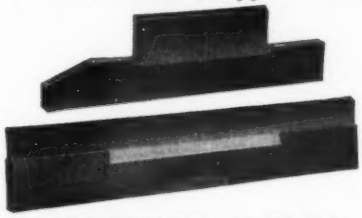
TUNGSTEN CARBIDE
TOOLS

CARBIDE
TIPPED...Work Support Blade



for CENTERLESS GRINDERS

Standard thrufeed and infeed work support blades available from stock. Prices on special blades quoted on receipt of prints.

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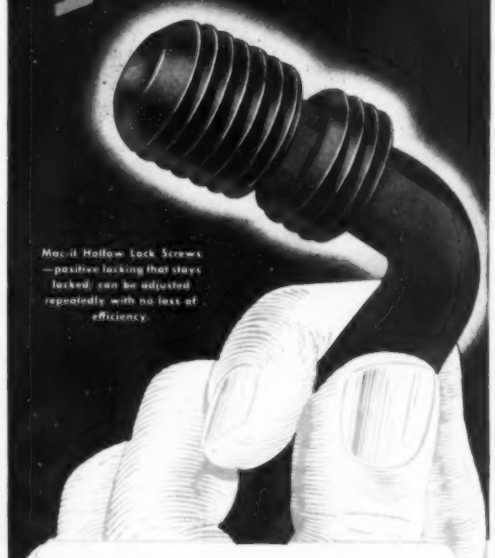
WILLEY'S CARBIDE TOOL CO.
SOLE MAKERS OF WILLEY'S METAL
1342 W. Vernor Highway Detroit 1, Michigan

IT'S A
Mac-it®
PRONOUNCED "MACK-IT"



Built for Strength!

For the toughest kind of fastening jobs, the complete Mac-it line of heat-treated, alloy steel screws will give you the strength you need *where you need it!*

Mac-it's 38 years' experience in the manufacture of these top-quality fasteners is your assurance of precision, uniformity and strength. Sold through leading industrial distributors from coast to coast and in Canada.

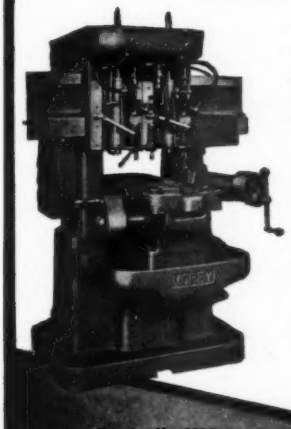
Other Mac-it products include:

Socket Head Cap Screws
Hollow Set Screws
Stripper Bolts
Hollow Pipe Plugs
Socket Screw Keys
Square Head Set Screws
Hexagon Head Cap Screws
. . . and many others

Marketed Nationally Since 1913 by
STRONG, CARLISLE & HAMMOND COMPANY
Cleveland 13, Ohio
Manufactured by MAC-IT PARTS COMPANY, Lancaster, Pa.

OREY
ESIGNED AND BUILT
For PRECISION Plus PRODUCTION

MOREY VERTICAL PROFILER
AND MILLING MACHINE



Over 2000 Morey Profilers in continuous service assuring speedy production for the United Nations in duplicating small parts.

Cross head is balanced on vibration-free cross rail . . . Clearance between spindle and table easily increased or decreased . . . Spindles mounted on precision bearings . . . Ball bearings throughout . . . Slides ride on scraped ways and are adjustable against future wear.

Ample provision for lubrication . . . Simple adjustment takes up backlash . . . No chatter marks on work . . .

Circular No. 580A

MOREY MACHINERY CO., INC
410 Broome Street New York, N. Y.

TO ADD

Superior Paint Performance

TO YOUR PRODUCT'S SALES FEATURES . . .

USE Bonderite UNDER THE PAINT

Quality products should look the part —on the showroom floor and in service. To guard the good looks of painted metal, leading manufacturers use Bonderite before painting.

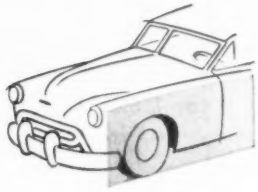
Bonderite, Parker's corrosion resistant paint base, converts the metal surface to a nonmetallic phosphate coating, provides a sure anchor for paint and protection for the metal against the formation of rust and corrosion.

Bonderite application is positive, quick, easy to control, dependable, low in cost, and effective on products that range from automobiles and trucks to kitchen mixers.

Your painted metal product should have the assurance of superior paint performance that Bonderite brings. Full information is yours on request.

Parker Products meet government specifications

Available for your guidance—a list of government finish specifications and the Parker Products which meet their requirements. Write for your copy.



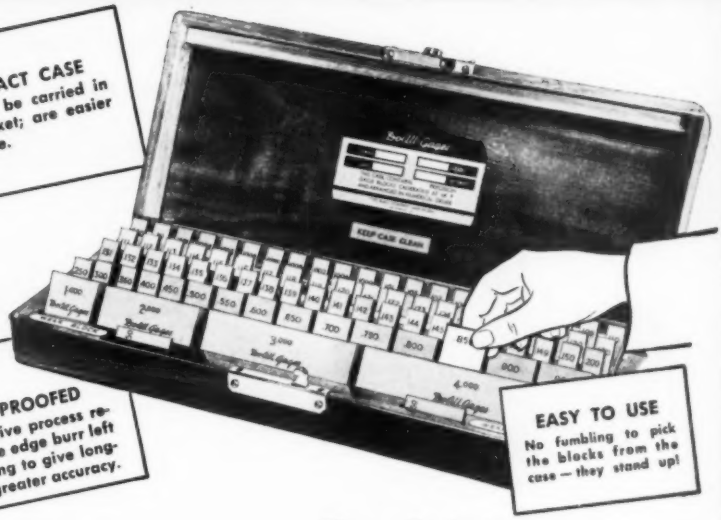
Bonderite, Parco, Parco Lubrite—Reg. U.S. Pat. Off.

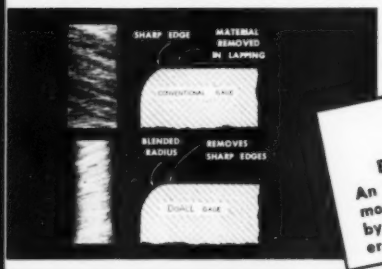
PARKER — Parker Rust Proof Company

2196 East Milwaukee Avenue, Detroit 11, Michigan

BONDERITE—Corrosion Resistant Paint Base • PARCO COMPOUND—Rust Resistant • PARCO LUBRITE—Wear Resistant for Friction Surfaces

COMPACT CASE
They can be carried in your pocket; are easier to handle.





BURR-PROOFED
An exclusive process removes the edge burr left by lapping to give longer life, greater accuracy.

EASY TO USE
No fumbling to pick the blocks from the case — they stand up!

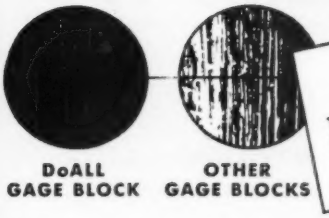
INDIVIDUAL CONTROL NUMBERS
Every block is numbered to keep sets matched, records accurate.

These Exclusive DoALL GAGE BLOCK features . . . mean Better, Low Cost, Quality Control

DoALL Gage Blocks are adaptable to literally thousands of critical inspection jobs. For example, with one set of 83 blocks and a few accessories *you can quickly make 120,000 different snap gages for about 1/4 cent each!* And you have micro-inch accuracy. DoALL Grade AA Gage Blocks are accurate to plus or minus two millionths of an inch; Grade A to four millionths; Grade B to eight millionths.

Use them for checking other instruments and finished parts. You cannot buy finer inspection equipment. DoALL Gage Blocks last longer, are easier to use, cost less in the long run than any others. *Ask to see DoALL Gage Sets at your plant*—your local DoALL Sales-Service Engineer will demonstrate them for you.

THE DoALL COMPANY, 254 N. Laurel Ave., Des Plaines, Ill.



DoALL GAGE BLOCK **OTHER GAGE BLOCKS**

SUPER-FINE SURFACE FINISH
The primary reason why DoALL Gage Blocks last so long. Note the comparison.

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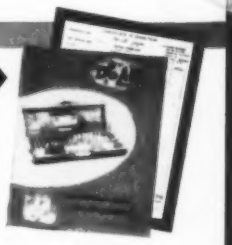
DoALL-developed accessories multiply Gage Block usefulness a thousand-fold.

MODERN MEASUREMENT CONTROL
Send for this new 20 page Bulletin describing DoALL Gage Blocks and Accessories. Ask about DoALL Calibration Service for your present gage blocks!



DoALL

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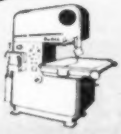
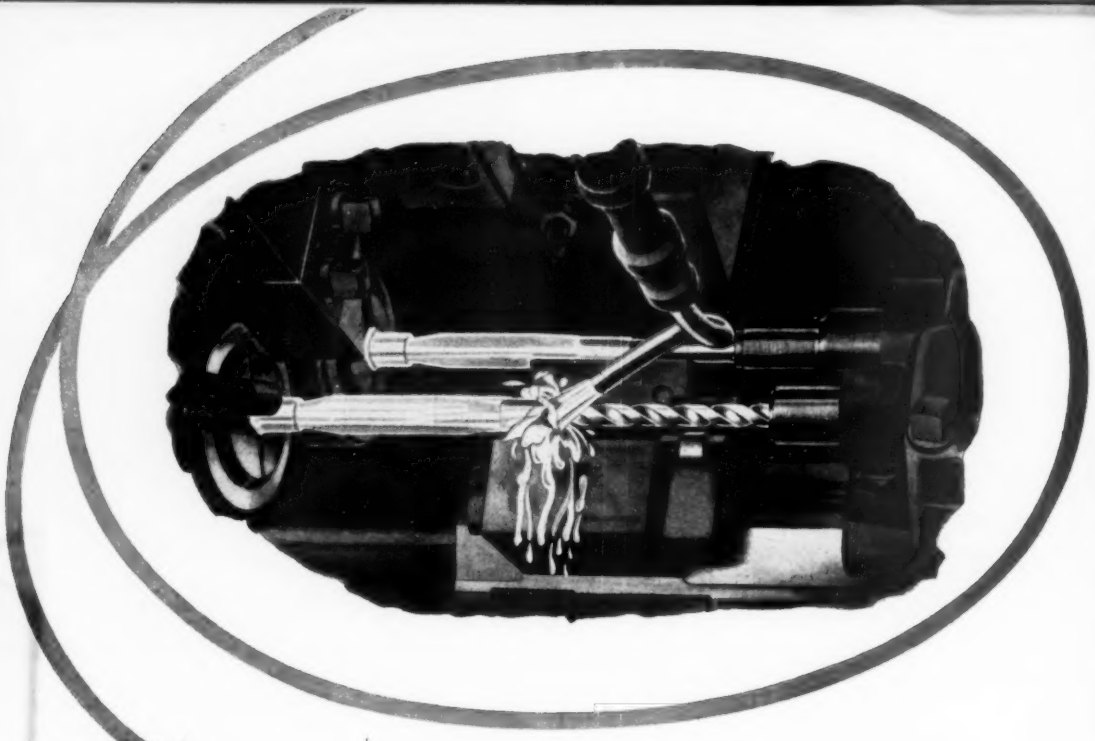


Machine Tools . . . Gaging Equipment . . . Tool Steel . . . Band Tools . . . Metal Working Supplies

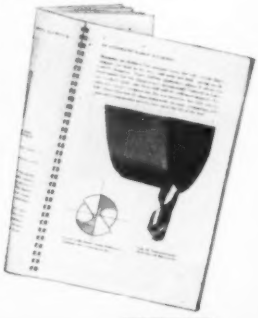


ALUMINUM REARMAMENT JOBS WILL CALL FOR DEEP DRILLING

SETUP IS EASY . . . Deep drilling can be done in any of the Standard Alcoa Screw Machine Stock Alloys. But if deep drilling is the primary consideration, 17S-T4 is best for the job.

Use straight fluted drills for average depth holes. In 24S-T4 and 61S-T6 alloys, use either high or slow spiral drills. All three have wide flutes that readily pass up the chips. For very deep holes use half round drills. Use a standard drill first, to a depth of about three diameters, then follow with the half round drill.

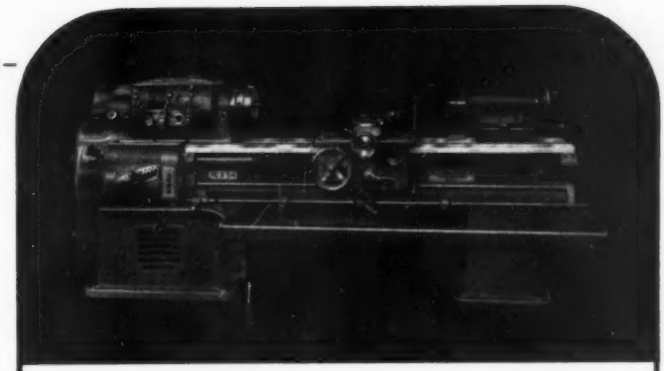
THE TECHNIQUES ARE HERE... Alcoa's free, 95-page book, "Alcoa Aluminum in Automatic Screw Machines," devotes an entire chapter to drilling. You'll find practical information on margin and web thinning, drill angles, back-outs and multiple drill setups. It's packed with detailed information on all phases of tool design, setup and operating techniques. Ask your Alcoa Sales Office, or write to: ALUMINUM COMPANY OF AMERICA, 871H Gulf Bldg., Pittsburgh 19, Pa.



ALCOA

ALUMINUM SCREW MACHINE STOCK

Standard Model—



MODERN Hendey

16", 18-speed engine lathes – for precision turning

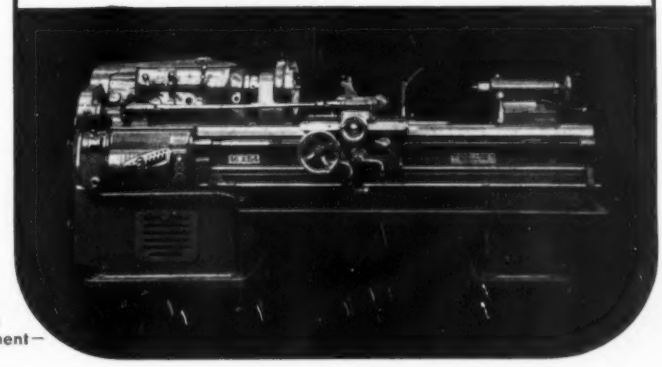
FEATURING induction hardened and ground precision bed ways

PLUS—

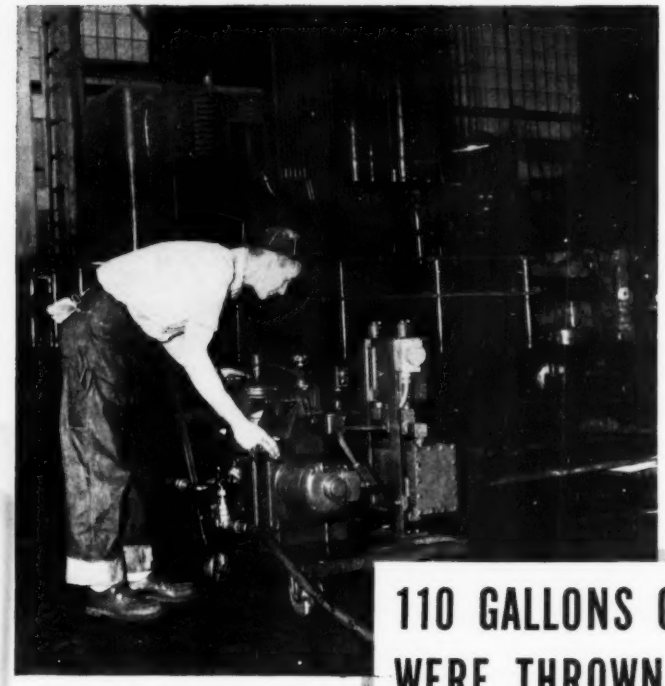
18-Speed Sealed Precision Geared Head.
Quick Change Gear Box Mechanically Oiled.
36 Thread Cutting and Feed Changes.
1½ to 80 Threads—.003 to .1666 Feeds.
Alloy Steel Gears in Headstock.
Gears Refinished After Heat Treatment.
Gear Shafts Mounted in Anti-Friction Bearings.
Anti-Friction Spindle Bearings Double Opposed, Pre-loaded.
Spindle End Indexed for Multiple Thread Cutting Without Disturbing Gear Train.
Apron and Carriage, Automatically Lubricated.
Quick Acting Levers Operate Longitudinal and Cross Feeds.
Feed and Split-nut Levers Interlocking and Fool Proof.
Quick Withdrawing Attachment for Threading.
Large Hole thru Spindle Accommodating Large Collet Capacity.
Spindle Nose Optional; Flanged Type Cam Locking, Long-taper Type Key Driven, Hendey Standard Threaded Nose.
Lathe Equipped with the New High Speed Apron Reverse for Lead Screw.
New Feed Dials, Large, Accurate and Quick Reading.
Micrometer Carriage Stop; Automatic Longitudinal Stops in Either Direction of Travel.
New Positive Cross Slide Stop.
New Re-inforced Bed Brackets with Anti-friction Bearing for Tail End of Lead Screw.
Special Clamping Device for Tailstock.

Every feature necessary for precision turning at modern production speeds is incorporated in the 16-inch, 18-speed Hendey engine lathe—in other words, *Built to Hendey's Modern Precision Standards*. The operator will find every convenience—from easy-operating controls to features that practically eliminate maintenance. Induction hardened and precision ground bed ways provide life-long precision for both carriage and tailstock. This modern Hendey Tool Room Lathe is available in standard and tool room models. The latter is shown below with sub-headstock for producing threads with long leads. *Write for catalog.*

THE HENDEY MACHINE COMPANY
MAIN OFFICE & PLANT: TORRINGTON, CONN.
BRANCH OFFICES: New York, Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco
REPRESENTATIVES: Philadelphia, Cleveland, Pittsburgh



Tool Room Model with sub-headstock & relieving attachment—



110 GALLONS OF WATER WERE THROWN OUT OF THE OIL!

This De Laval "Uni-Matic" Oil Purifier was installed in a mill to maintain the lubricating oil in twin millers. The first time that the machine was used to centrifuge the oil, 110 gallons of water and soluble oil were removed from the oil, plus a large amount of dirt and metallic particles. Small wonder that the quality of lubrication improved suddenly!

On routine service now, the De Laval keeps the lubricating oil in excellent condition by periodically freeing it of contaminants, both liquid and solid. With an adequate supply of clean oil available, repair costs dropped and "down" time due to impure oil was completely avoided.

This story is merely a typical illustration of the oft-repeated fact: you save more than the oil when you purify oil the De Laval way.

Write for details.

THE DE LAVAL SEPARATOR COMPANY
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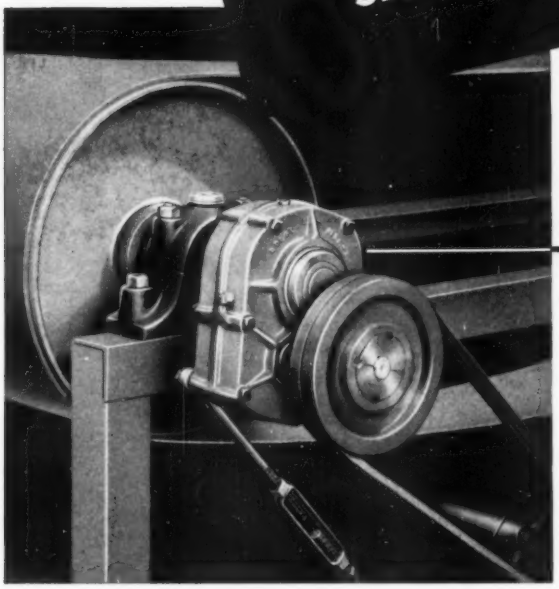
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL

PURIFIERS and CLARIFIERS for FACTORY OILS

FOR GREATER OPERATING EFFICIENCY

THE SPEED REDUCER THAT SAVES YOU MONEY!



Dodge

Torque-Arm

America's Most Complete Line of Shaft-Mounted Speed Reducers

- No special engineering required. No foundation to provide. No flexible couplings. No sliding base. No "lining-up" difficulties. No expensive installation. Stock TAPER-LOCK sheaves prescribed for each job to provide desired speeds. Application to other machines is practical and easy.
- Unit is driven through any V-Belt Drive. Torque-arm, fastened to any fixed object, anchors the reducer unit. Turnbuckle provides fast and accurate adjustment of belt tension.
- Backstop available from stock when required. Simple. Positive. Easily installed. Sealed inside the reducer housing.
- Compact, light weight, *rugged*. Quality built by Dodge for Dodge *dependable* service.
- Built in two series—Single and Double Reduction. Capacities from 1 to 27 h. p. Speeds from 12 to 330 rpm. Available from distributors' stocks.
- WRITE for special bulletin A602.

DODGE MANUFACTURING CORPORATION, 100 Union Street, Mishawaka, Indiana

DODGE

of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new cost-saving methods. Look for his name under "Power Transmission Equipment" in classified phone book.

FIRST IN POWER TRANSMISSION MACHINERY!

V-BELTS AND TAPER-LOCK SHEAVES

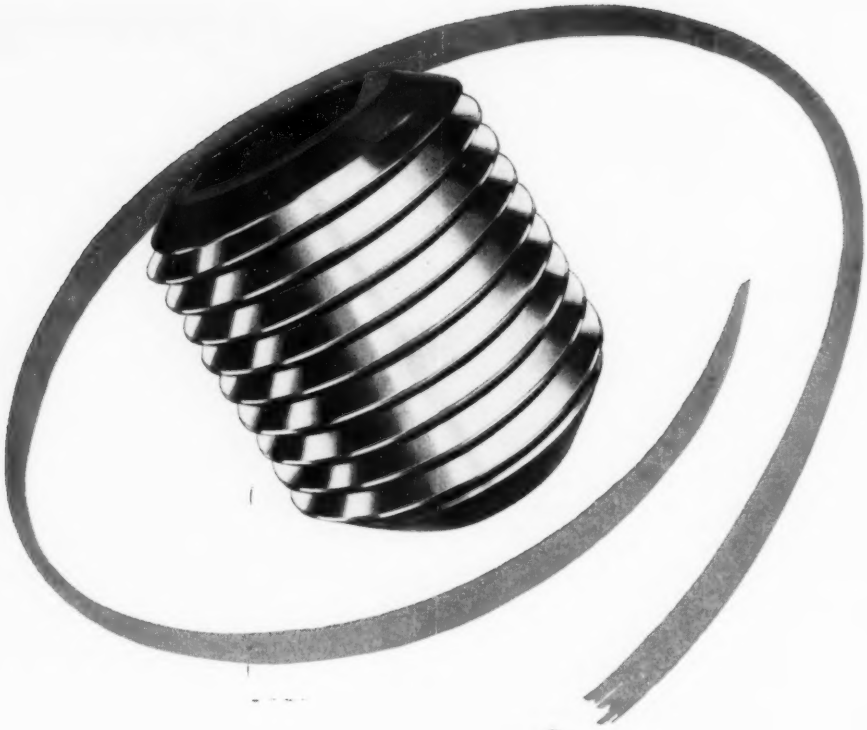
DODGE-TIMKEN PILLOW BLOCKS

ROLLING GRIP AND DIAMOND D CLUTCHES

SOLID STEEL CONVEYOR PULLEYS

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO, ILLINOIS



WANTED

for more of industry's finest products than ever before

Most products assembled with Socket Screws are engineered to meet demands for efficiency and endurance well above common standards.

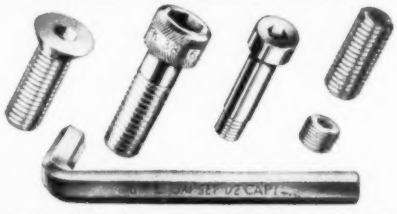
To make sure of fastenings equal in quality to other components, more manufacturers are specifying Parker-Kalon Socket Screws than ever before. The reasons are clear.

Just look at a P-K* Ground Thread Socket Set Screw, for example. You can see and feel the difference. By any standard of comparison, no finer screws are made. And the P-K Quality-Control makes sure that every screw in every box meets specifications.

P-K production is going all-out to meet this mounting demand. For D.O. or other assemblies, set your standards by P-K quality. Parker-Kalon Corporation, 200 Varick St., New York 14, N. Y.

P-K
TRADE MARK
REG. U.S. PAT. OFF.

FOR ANY TYPE OF SOCKET SCREW
REMEMBER — IF IT'S P-K . . . IT'S O.K.*



Flat Head Socket Cap Screws • Size-marked Socket Head Cap Screws
Stripper Bolts • Ground Thread Socket Set Screws • Pipe Plugs • Hex Keys
Available Through Accredited Distributors.

*Trade Marks Reg. U. S. Pat. Off.

PARKER-KALON*
cold-forged
SOCKET SCREWS

SKILL
helps make fine steels at JESSOP

There is a tradition of fine steelmaking at Jessop that acts as an incentive for greater skill to the men on the production team. Every millman, every melter . . . every single man in the Jessop Works takes pride in the fact that the name of Jessop has stood for the best in special steels for nearly two centuries. He is determined it shall continue to lead for many years to come. You can buy with confidence the custom-made steels made by Jessop men.

HIGH SPEED STEELS · HIGH SPEED BITS · PRECISION GROUND FLAT STOCK · HIGH SPEED AND ALLOY SAW STEELS · HOT WORK DIE STEELS · COLD WORK DIE STEELS · CARBON AND ALLOY STEELS · STAINLESS AND HEAT RESISTING STEELS · VALVE STEELS · STAINLESS-CLAD STEELS · CAST-TO-SHAPE STEELS · COMPOSITE TOOL STEELS · ARMOR PLATE

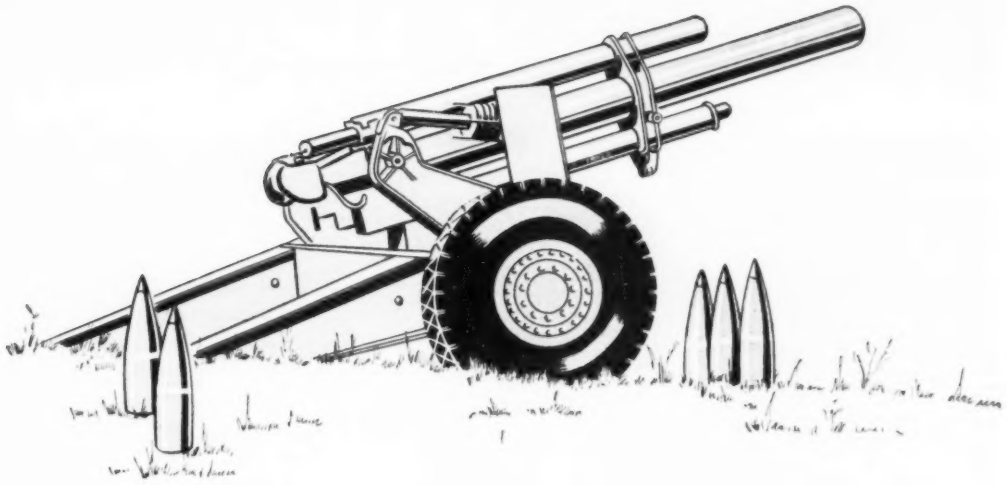
JESSOP
STEEL COMPANY · WASHINGTON, PENNSYLVANIA

TESTING might mean only cursory examinations or spot checks along the production line. But that is not good testing. Here—at BRAD FOOTE—men with skilled hands using modern precision instruments test constantly, during every step of manufacture. They realize that the responsibility of satisfying you, our customers, rests primarily with them. They know that *"No one shares our responsibility."*

• Our method of testing dimensions, hardness and soundness of metal structures, and smoothness of finish is part of our system of complete control. It means that the BRAD FOOTE gears you buy for use on equipment you sell to others—or for use in your own shop—will give satisfactory service.

BRAD FOOTE GEAR WORKS, Inc.

Bishop 2-1070 • OLympic 2-7700 • 1309 South Cicero Avenue
Cicero 50, Illinois



Blasting an old-fashioned coolant idea!

More and more machinists are cutting coolant costs and improving production by using Houghton *Antisep* "across the board". They're finding this all-purpose base covers better than 90% of their metal-cutting jobs. They're convinced it's getting old-fashioned to use a different coolant for every operation in the shop.

You'll use Antisep for general machine work . . . for automatics . . . for stamping and forming. You'll handle one instead of many cutting oils. You'll save space, write smaller inventories, simplify selection. Two good examples of precision machining with Antisep All-Purpose Base are given here.

Ask the Houghton Man to show you how Antisep can be used as coolant and die lubricant over many operations. Or write E. F. Houghton & Co., Philadelphia 33, Pa., for full information and prices.

TWO GOOD EXAMPLES OF ANTISEP'S DEFENSE APPLICATIONS

One well-known plant machining shells is using Antisep to 25 parts water in:

1. Rough turning
2. Semi-finish turning
3. Machining nose
4. Shell body turning and finishing
5. Cutting off center boss
6. Cutting and finishing recess band groove

In machining of 15-ft. 90 mm guns, another plant performs the following operations using Antisep mixed with water in proportions shown:

1. Reaming (1 to 20)
2. Machining powder chamber (1 to 15)
3. Machining breech end (1 to 30)
4. Machining muzzle end (1 to 30)

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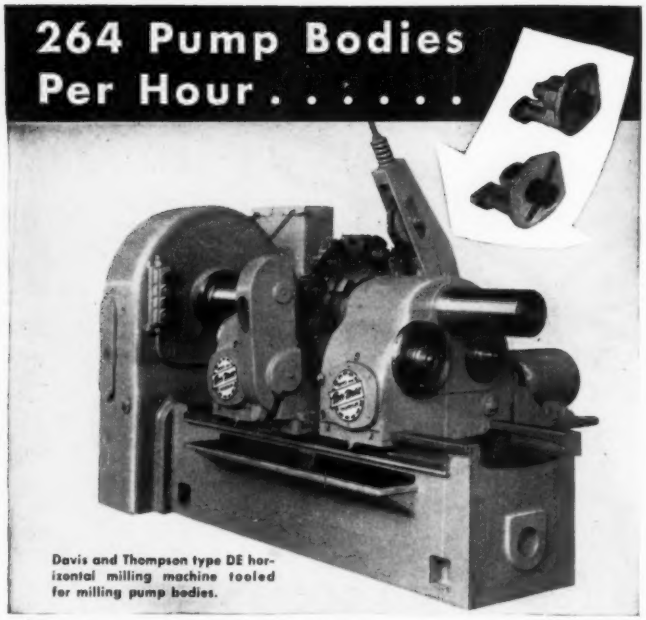

Davis and Thompson type DE horizontal milling machine tooled for milling pump bodies.

1-A Standard Horizontal Milling Machine

Oil pump bodies requiring high degree of finish and high production are rough and finish milled on both sides simultaneously with this Davis and Thompson type DE milling machine. Production is 264 pieces per hour.

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A Basically Standard Machine Employing Roto-Matic Principle For High Production Special Milling

Like all D&T machines this model DE is designed for long life and trouble-free operation. Each head has independent drive. There is backleash take up to mandrel. Anti-friction bearings throughout. Rapid traverse between cuts can be incorporated.

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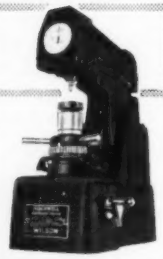

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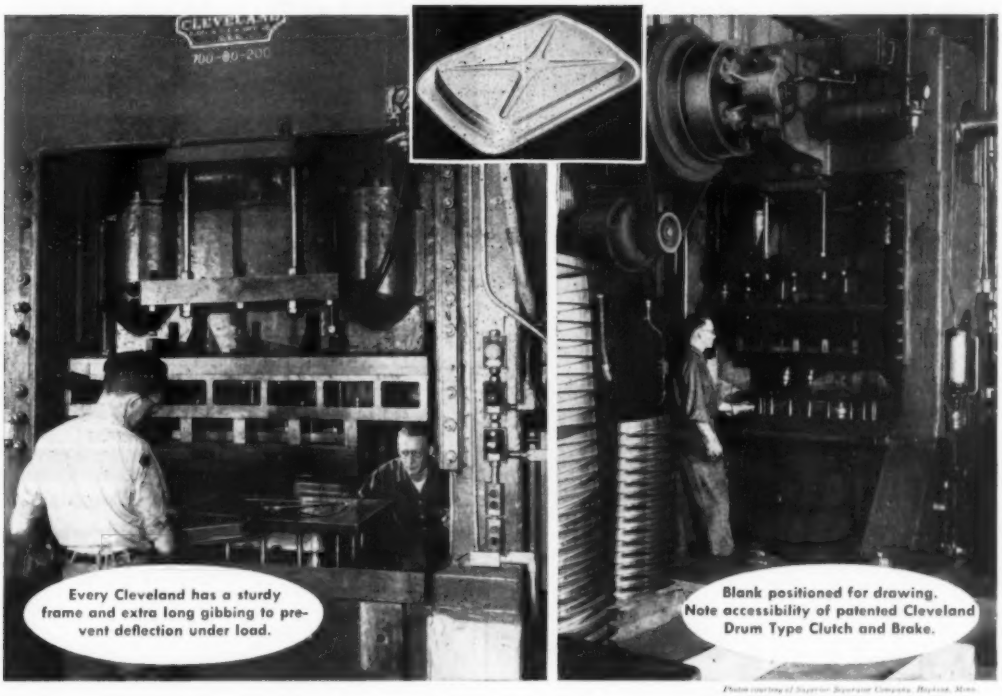
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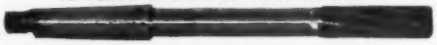

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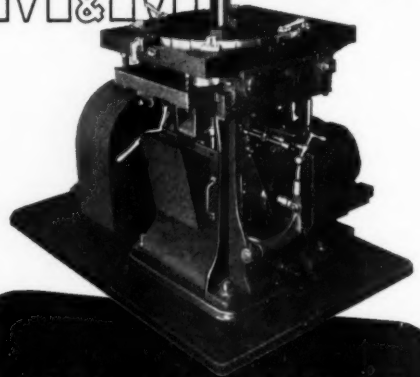

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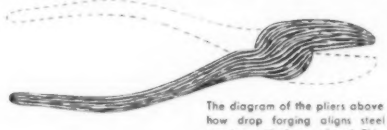

The diagram of the pliers above shows how drop forging aligns steel fibre structure with shape of tool. This means rugged strength.

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Fibre structure is straight—does not conform to the shape. Fibres are cut off. The tool is relatively weak.

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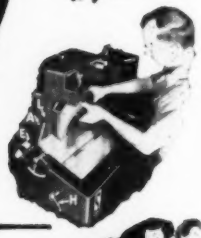
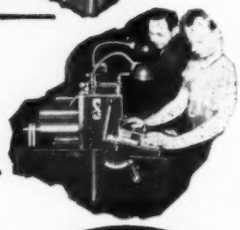


(Right) Mounting a new wheel in 5 minutes!

(Right) Operating view of 10 TD shows ample room to comfortably serve two operators. (Twin lights are optional.) Complete operator comfort when grinding wet. Absolutely no spray or splash.



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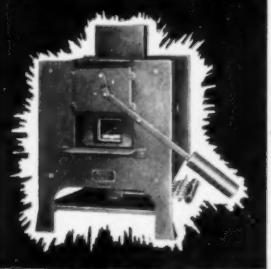

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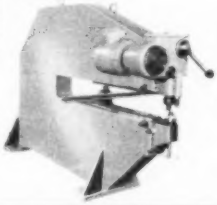

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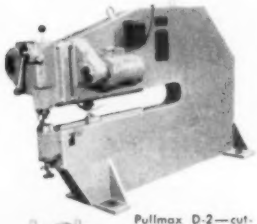
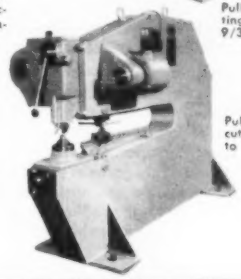
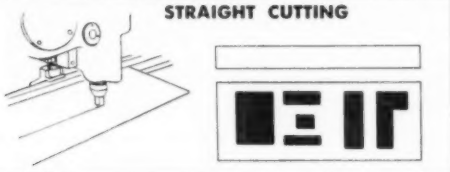
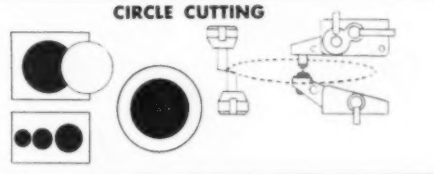


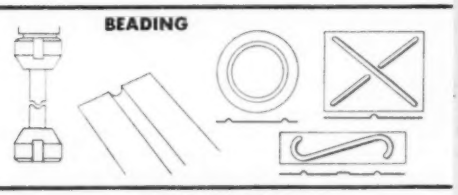
Pullmax D-2—cutting capacity up to 9/32".

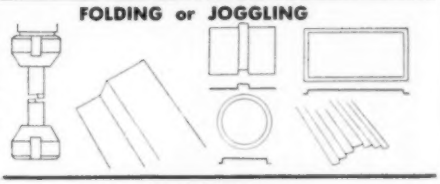


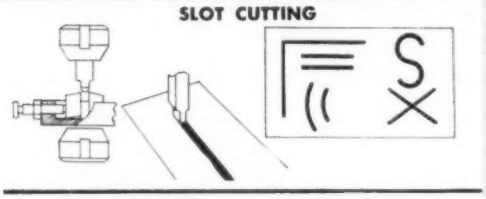
Pullmax Major—cutting capacity up to 11/32".

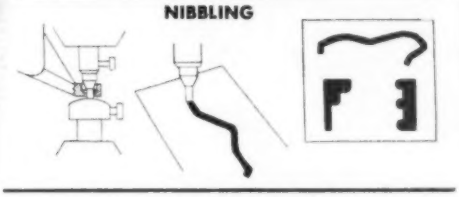


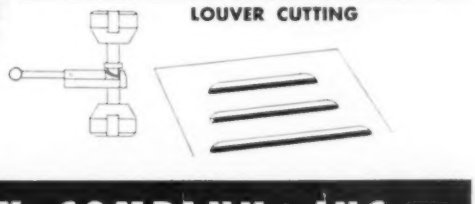












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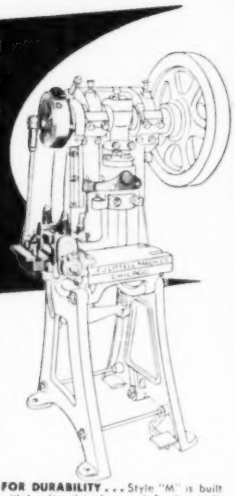

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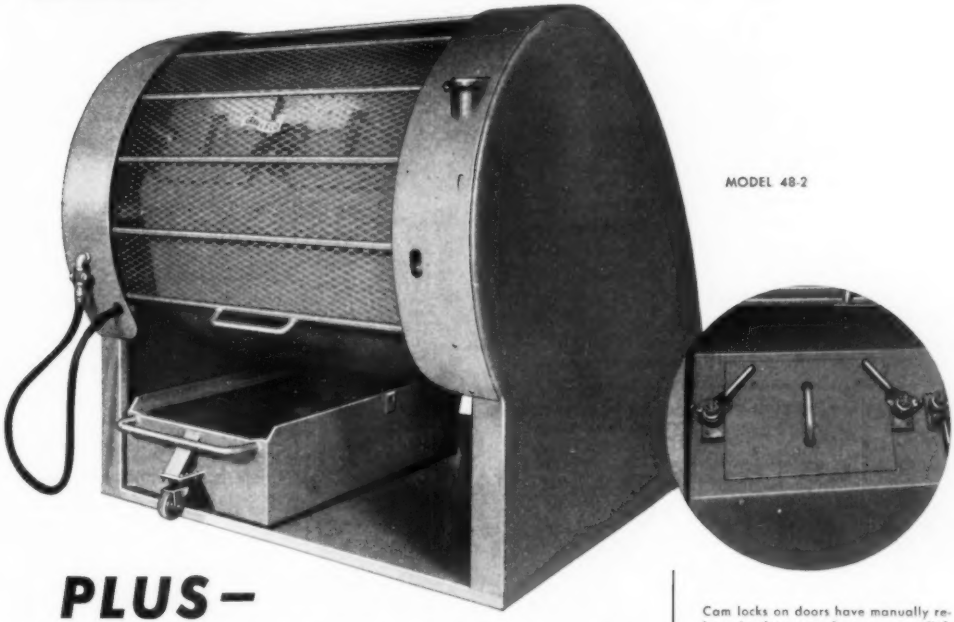

MODEL 48-2

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Grav-i-Flo Tumbling Machines are designed to produce more work in less floor space. That's why so many companies have chosen Grav-i-Flo to handle all their tumbling needs. These manufacturers have compared Grav-i-Flo to other tumbling machinery and have found—First: that Grav-i-Flo machines, in each model, occupying the same floor space, have a 31% to 80% greater capacity; Second: that Grav-i-Flo machines cut from 15% to 25% faster; Third: this shortened processing cycle permits reduction in the required number of machines for an installation, thus benefiting capital investment, floor space and production time; and, Fourth: Grav-i-Flo tumbling machines in all models have such exclusive features as advanced design on door locks and safety guards, and cylinder removal for easier maintenance.

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New Grav-i-Flo machines available in a number of models to meet all tumbling requirements. Compartments furnished ½" plate unlined or ¼" plate rubber lined. Reduced voltage control on magnetic starter. Lever or push-button switch. Limit switch on safety guard. 220-440 volt, 3 phase, 60 cycle motor with magnetic brake. Water attachment with hose. Counterbalanced safety guard. Hoist pan has tubular yoke with manually operated lock.

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Motor Driven Separator—welded frame supports hoist pan. Separating screen, adjustable from 0° to 1½", accomodates various sizes and types of parts. Screen inclined 5° maximum. Pan shelf provided for stock pan. 1 H.P., 220-440 volt, 3 phase, 60 cycle motor with speed reducer, and manual starter with overload protection.

Samples Processed Free! The Grav-i-Flo Sample Processing Department will gladly tell you how to attain a better finish at lower costs. Send samples direct to The Grav-i-Flo Corporation.

THE GRAV-I-FLO CORPORATION

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Wahlstrom—only fully automatic drill chuck holding widest range of straight-shank tools—is available in Model A (1/32" to 1/2"), Model AA (1/64" to 3/8"), Model B for larger straight-shank tools, Model C for taper shank tools, and fully automatic tappers.

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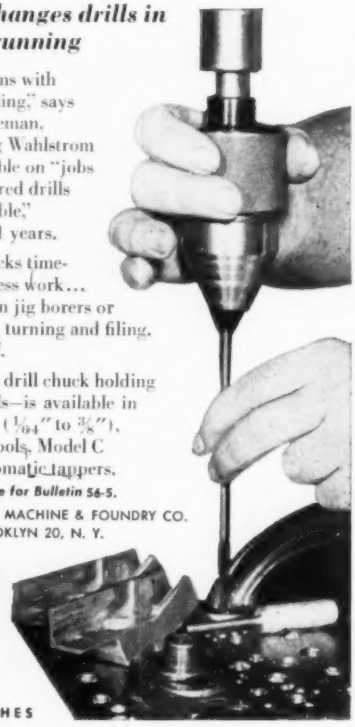

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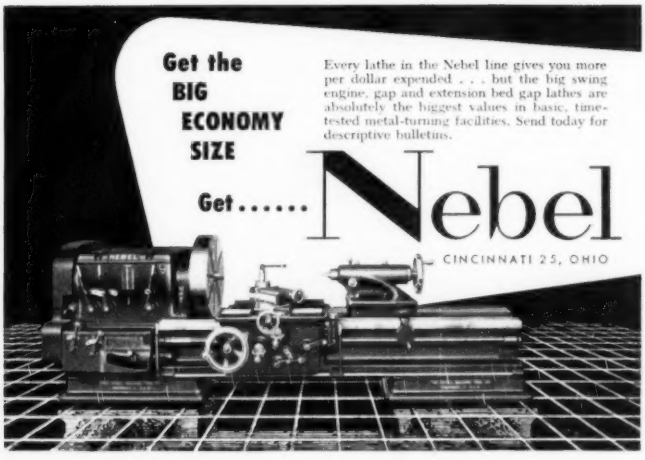

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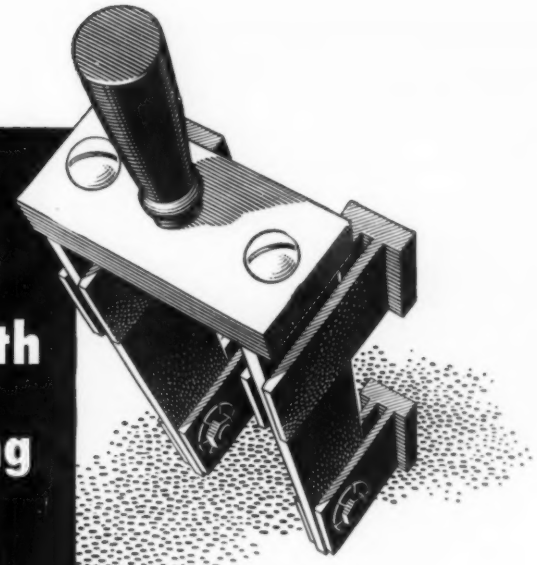

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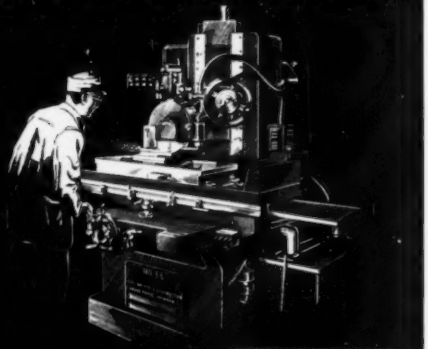

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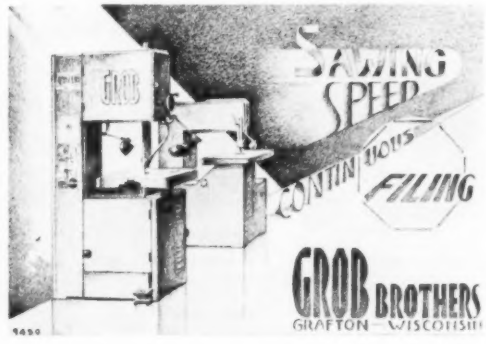

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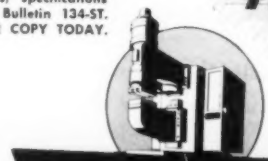

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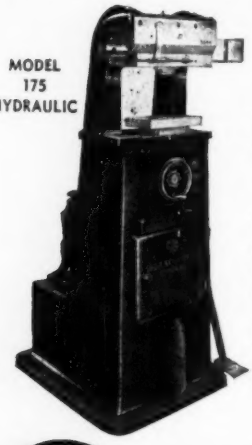

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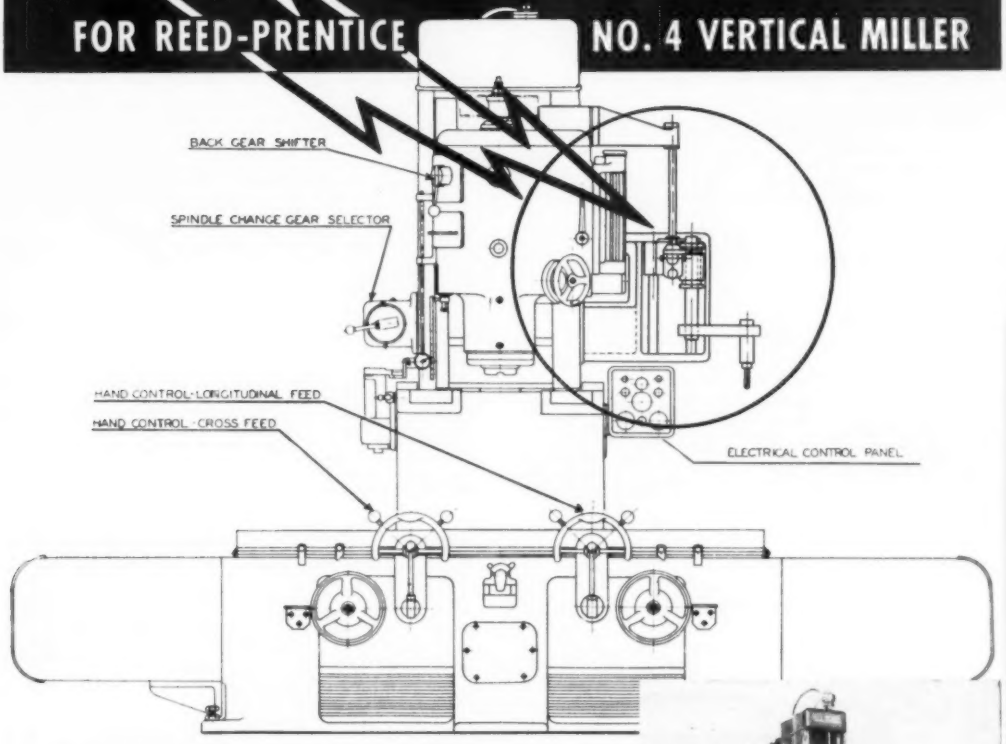

● The Raytheon Electronic Duplicating Attachment for Reed-Prentice #4 Vertical Millers assures highly accurate, automatic duplication of parts in die sinking and profiling work. Send us specifications on your duplicating problems and we'll gladly show you how to make substantial savings.

SPECIFICATIONS — Machine Size	48"	60"
Longitudinal travel of table	48"	60"
Travel of cross slide	24"	24"
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Table to spindle nose, max.	24"	24"
Feeds	Infinitely	variable
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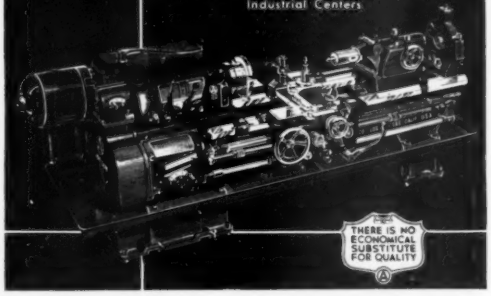

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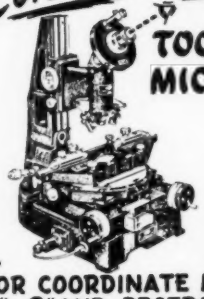

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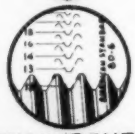

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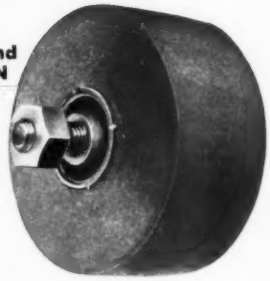

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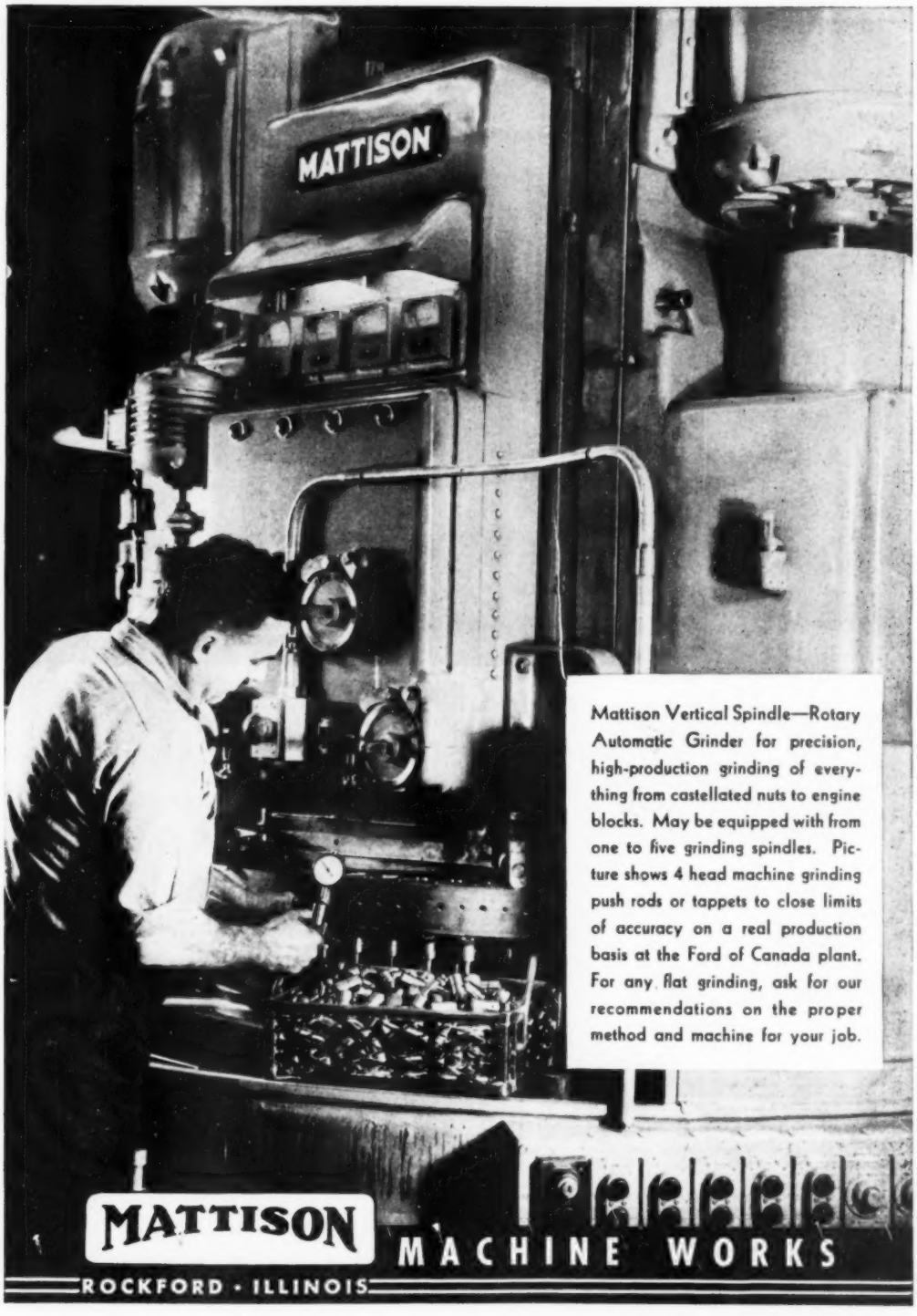
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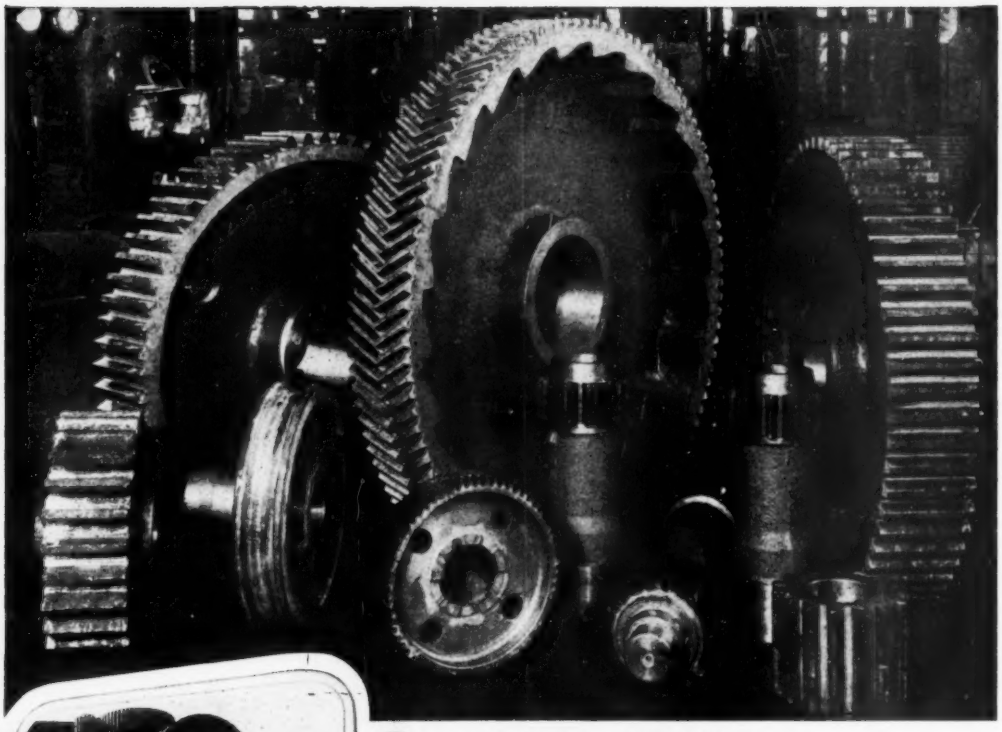

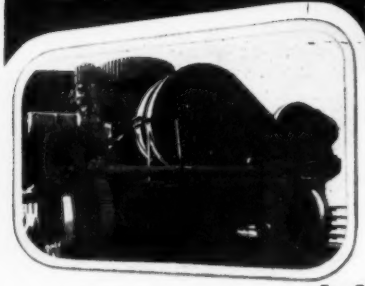

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S.A.E. 1020 Case-Hardened (Surface)	260/300,000	180/195,000	5–10	8–10	514–601	70–77
S.A.E. 1020 Case-Hardened (Core)	60/ 70,000	30/ 35,000	30–35	40–50	120–140	17–21
Neloy Annealed and Flame-Hardened Treatment 10B (Surface)	218/270,000	190/240,000	8–12	20–35	477–601	66–77
Neloy Annealed and Flame-Hardened Treatment 10B (Core)	85/ 90,000	55/ 65,000	23–40	30–40	163–170	25–26
S.A.E. 1020 Case-Hardened (Surface)	260/300,000	180/195,000	5–10	8–12	514–601	70–77
S.A.E. 1020 Case-Hardened (Core)	60/ 70,000	30/ 35,000	30–35	40–50	120–140	17–21
Neloy Heat Treatments No. 3 and 10B (Surface)	220/270,000	200/240,000	8–12	20–35	555–601	73–77
Neloy Heat Treatments No.3 and 10B (Core)	100/110,000	80/ 90,000	20–26	40–50	207–241	32–36
S.A.E. 2315 Case-Hardened (Surface)	290/329,000	185/205,000	4– 8	6–10	578–653	75–81
S.A.E. 2315 Case-Hardened (Core)	112/129,000	99/120,000	12–20	38–51	248–277	37–41
Neloy-Molybdenum, Normalized, Drawn and Flame-Hardened (Surface)	258/281,000	212/247,000	6–10	8–12	514–555	70–73
Neloy-Molybdenum, Normalized, Drawn and Flame-Hardened (Core)	90/110,000*	65/ 85,000*	18–25	30–40	187–223	28–33
S.A.E. 2315 Case Hardened (Surface)	290/329,000	186/205,000	4– 8	6–10	578–653	75–81
S.A.E. 2315 Case-Hardened (Core)	112/129,000	99/120,000	12–20	38–51	248–277	37–41
Neloy-Molybdenum Heat Treatments 3A and 10B Flame-Hardened (Surface)	282/318,000	217/265,000	4– 8	6–10	555–627	73–79
Neloy-Molybdenum Heat Treatments 3A and 10B Flame-Hardened (Core)	132/150,000	120/135,000	10–18	25–35	285–321	42–47

*The variation in tensile and yield in the third table is due to the alloyed elements of 2315 which is a nickel steel. This produces a higher physical on a straight annealed steel compared with more economical alloy used in Neloy-Moly.

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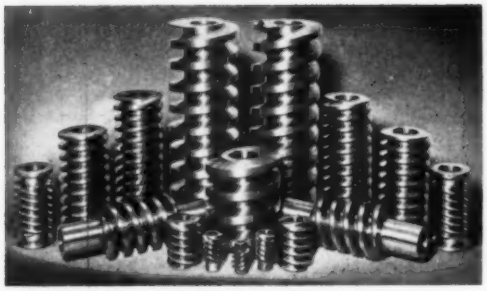

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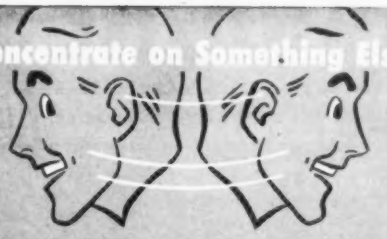

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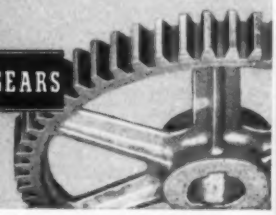

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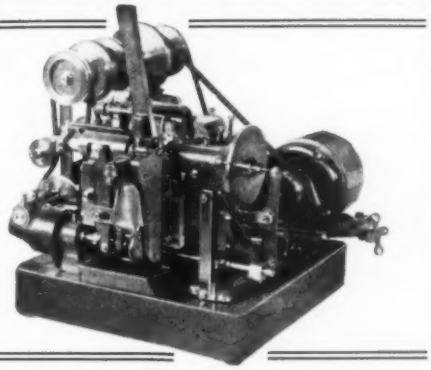

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MACHINE OF THE MONTH

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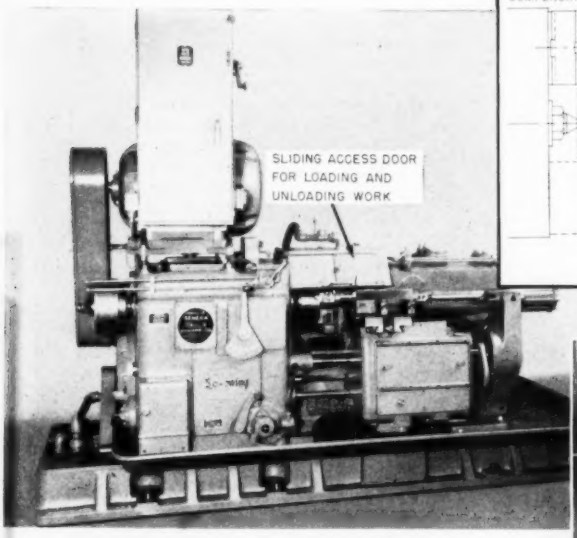

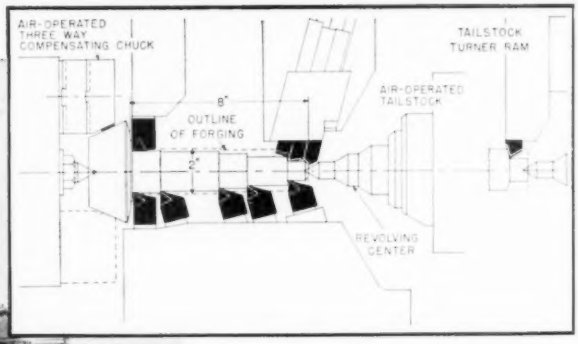

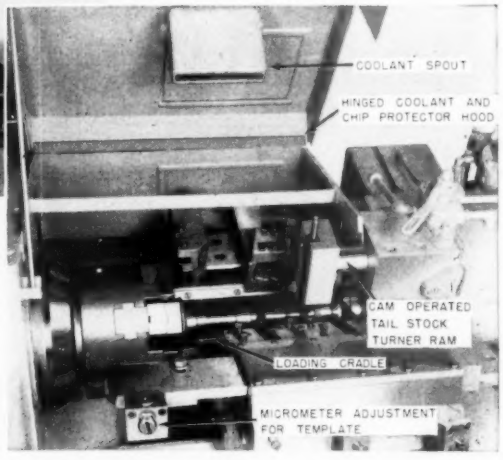
COOLANT SPOUT
HINGED COOLANT AND CHIP PROTECTOR HOOD
CAM OPERATED TAIL STOCK TURNER RAM
LOADING CRADLE
MICROMETER ADJUSTMENT FOR TEMPLATE

MODEL "AR" AUTOMATIC Lo-swing LATHE TURNS REAR AXLE PINION AT FAST PACE

Problem: **Turn and face all stem diameters of Axle Pinion simultaneously, taking two cuts over the threaded diameter to remove large amount of surplus material.**

Solution: **The Model AR Lo-swing Lathe selected for this job was equipped with a cam-operated auxiliary turning ram mounted on the tail-stock casting and fitted with a carbide tool for removing surplus material ahead of a front carriage turning tool which does the sizing. The broken line on the drawing shows the actual shape of the forging and the large amount of surplus material at the threaded end. This drawing also shows the disposition of the tooling for turning and facing all diameters. All tools are tungsten carbide cutting at high surface speeds.**

The machines supplied for this job were equipped with heavy chip guards to protect the operator from flying chips and coolant. Upper illustration shows the front sliding door thru which work is loaded and unloaded. Lower illustration shows the entire hinged hood in an upright position to facilitate tool changes and adjustments. Note that the coolant spout is attached to and moves with the hood. This view also shows the cam operated tailstock turner ram and the loading cradle for the parts.

In operation, the operator simply opens the sliding door, places a rough forging in the loading cradle and closes the door. The air operated tailstock center pushes the part into position on the headstock center, the chuck jaws clamp the piece and the machine is then started. A safety devise prevents starting of the machine spindle before the chuck jaws are closed, thereby preventing damage to the cutting tools and other equipment.

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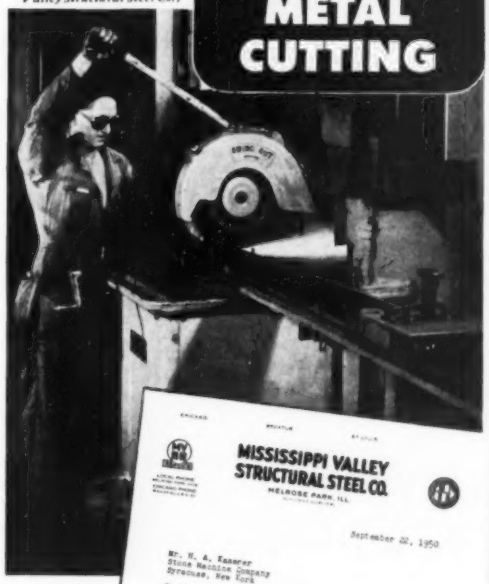
(Photo Courtesy Mississippi Valley Structural Steel Co.)



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September 22, 1950

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Syracuse, New York

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Yours very truly,

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Shop Superintendent

WAS:ov

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Drills that are sharp and correctly ground will (1) drill to exact size (2) drill faster, (3) drill more holes per grind, (4) drill the same with each lip, (5) require less power to drill, (6) reduce breakage, (7) cost less to regrind and increase the life of drill by removing less metal when grinding.

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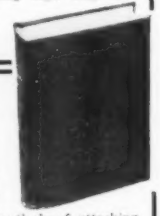

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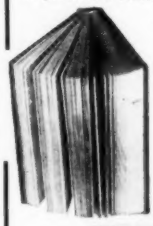

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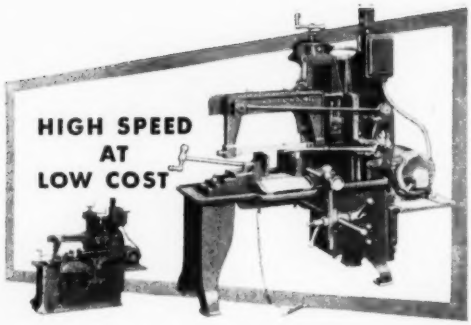

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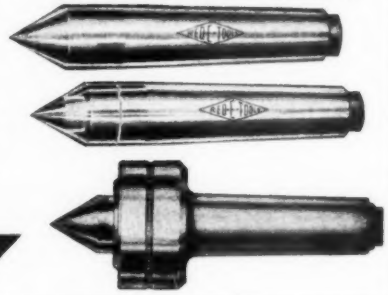

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EAGLE EP PICHER

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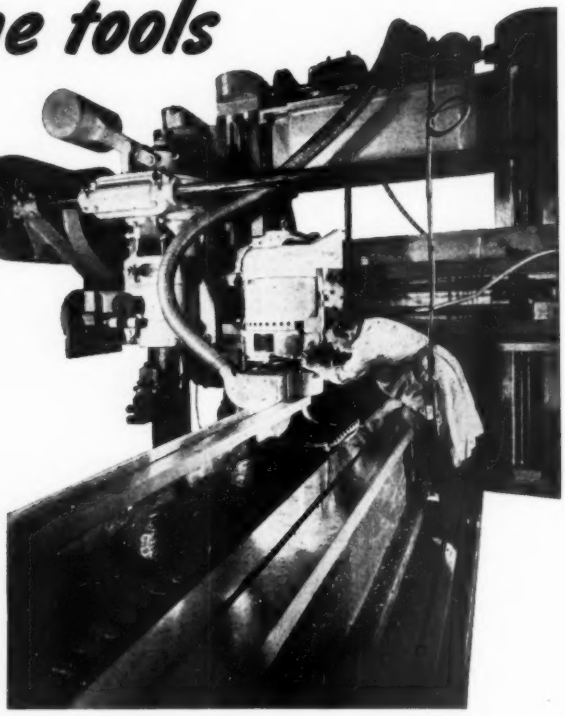

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1. **Take a *physical* inventory of your machine tools, particularly the heavy, hard-to-replace ones.**
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Your maintenance engineers or work managers will find working with Simmons' engineers helpful in determining what improvements are required in your machine tools—hydraulic drive, conversion to motor drive and application of power rapid traverse, lengthening of beds or tables, widening of housings, raising of rails or heads, new type surface finishes such as hardened steel ways or labor-saving devices.

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CONTRACT WORK

SEARCHLIGHT SECTION

(Classified Advertising)

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- Hand assembly of small parts

In addition to a well-equipped toolroom, manned by skilled personnel, Arrow has a large, experienced engineering and design department capable of furnishing valuable assistance from development to the finished product. Our purchasing department has had extensive experience in obtaining a wide range of diversified materials.

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Use "Searchlight"—at low cost—to feature your wants or offerings . . . whether it concerns employment, buying or selling used or surplus new equipment, or other pertinent business "opportunities."

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5½" bar Niles, m.d.
10" bar Sellers Floor Type, m.d.
Pair tables for use on Floor Type Horiz. Boring Mill 8'9" long x 17½" wide x 38" high, 2T slots
Floor Plate 76" wide, 21'8" long overall, 9" thick, 5T slots
Pair tables for use on Floor Type Horiz. Boring Mill, 8' long x 15¾" wide x 33" high, 2T slots

VERTICAL BORING MILLS

24" Bullard New Era, m.d., with side head
30" Bullard, 5 station turret head on cross rail, fixed rail type, old
42" Colburn, m.d., 1 swivel head, 1 turret head, p.r.t.
42" King, belted m.d., 2 swivel heads, p.r.t.
44" Niles, m.d., 2 swivel heads, p.r.t.
48" Putnam H.D., m.d., 2 swivel heads
53" Niles, 2 heads on rail
96" Cincinnati Heavy Pattern, 2 heads on rail, p.r.t.
100" Niles Heavy, m.d., p.r.t.

BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d.
Cincinnati Mill Broach, m.d., 10" spindles, new

BALL BEARING DRILLS

Canedy Otte Bench Type, 8" overhang
Allen Bench Type, m.d., ½ H.P. motor, 12" overhang
Automatic Sensitive, m.d., ¼" cap.
Mason Bench Type Single Spindle, belt
Providence Engineering Co., Model E, s.p.d.
No. ½, 1, 2 Avey, belted m.d.
No. 1B Edlund, m.d., new
No. 2—12" Foote-Burt Single Spindle, m.d.
No. 4 Fosdick, 8" overhang, belted m.d., No. 2 Taper
No. 5M—16" Fosdick, m.d.
1 spindle Allen, belt drive
2 spindle Allen, belted m.d., 6" overhang
2 spindle Avey, size No. 1, Type B, style VHP, m.d., 8" overhang
2 spindle No. 3 Avey, belted m.d., p.r.
4 spindle No. 3 Avey, belted m.d., No. 3 Taper, 12" overhang
6 spindle Leland & Gifford, No. 2 Taper, m.d. on each spindle
6 spindle No. ½ Avey, model MAS, m.d., latest
6 spindle No. 2B Edlund, m.d., No. 2 Taper
6 spindle No. 3 Avey, belted m.d.
6 spindle Henry & Wright, m.d. 15" overhang No. 2 Taper

2 ILMS—3 spindle Leland & Gifford High Speed, m.d., late

HORIZONTAL DRILLS

No. ½ Bx30" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. 1"Bx50" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. 1Bx74" Pratt & Whitney 2 spindle Deep Hole Drill, m.d., latest
No. 1½x105" Pratt & Whitney 2 spindle Deep Hole Drill, m.d., latest
No. 1½x105" Pratt &Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 1 Pratt & Whitney 2 spindle Deep Hole Drill, belted m.d.
No. 1½ Pratt & Whitney 2 spindle, m.d., older type
Pratt & Whitney Rifling Machine belt
5 spindle Detroit Semi-Automatic Drill, belt
2 spindle No. 410 W.F. & John Barnes Deep Hole Drill, m.d.
Special Horiz. Drilling Machine, Cincinnati-Bickford Head mounted horizontally on base

MULTIPLE SPINDLE DRILLS

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No. 3 Baush, m.d., 20x40" head, 15 spindles
No. 16 Foote-Burt Fixed Center, m.d.
3 spindle 24" Barnes All Geared Self-Oiling, m.d.
3 spindle 12" Rockford Gang, m.d.
4 spindle Foote-Burt Rail, No. 4 Taper, m.d.
4 spindle Niles-Bement-Pond, m.d., 12' rail, No. 5 Taper

RADIAL DRILLS

3' American Sensitive, cone
4' American Triple Geared Plain, 13" col., m.d. thru gear box on base
4' Niles-Bement-Pond Semi-Universal, m.d.
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#1A Warner & Swasey Turret Lathe
#30 Waterbury Farrell Thread Rollers
#0 Brown & Sharpe Automatic Screw Machines with Turner Drives
#3 Barber Colman Hobbing Machine
G1-A Acme Gridley 1½ Automatic Screw Machine
#262 Barnes Camel Back Drill
#0 Giddings & Lewis 3½" Bar Horizontal Boring Mill

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E-2	8.00	N-1	24.00
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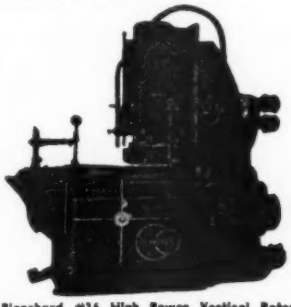
AUTOMATIC, National-Acme Sgle. Spdl. 4¼".
BORING MILL, Lucas #31 Horiz. 3" Bar.
BORING MILL, Giddings & L. #32 Horiz. 3½" Bar.
BORING MILL, Ryerson #11 Horiz. #6 M.T.
BORING MILL, King 42" Vertical, A.C. Motor Dr. Power Rapid Traverse with side head.
BORING MILL, #0 Giddings & Lewis, 3½" Bar.
BORING MILL, Bullard 36" Rapid-Prod., M.D.
BORING MILL, 61" Bullard MAXI-MILL, 2 heads
BORING MILL, Cleveland Horiz. 2½" bar, cap.
BOREMATIC, Heald #49 Sgle. End, & D. E.
BRAKE, Verson Press T15-10, 10'x½" cap.
BROACH, Gilgear Hydr. 10 Tons Horiz. 50" Str.
COMPRESSOR, Chicago Pneumatic 178 CFM.
CHIP WRINGER, Barrett #251, M.D., 18" dia.
CUTTER, 74" Oswego Automatic Paper, M.D.
RADIAL DRILL, Foodick 5' Arm, 14" Col. #5 M.T.
RADIAL DRILL, Carlton 4'-15". Motor on Arm.
RADIAL DRILL, Cinci.-Bickford 3½x9", A.C., M.D.
RADIAL DRILL, Cinci.-Bickford 5' arm, 13" col.
DRILL, Deep Hole, Avey-Draulic #2.
DRILL, Deep Hole, Pratt Whitney #2 Gun Barrel
DRILL, Edlund #2B, 3 spdle. #2 M.T., 16".
DRILL, Cincinnati 21" with Tapping Attach.
DRILL, Natco Multiple Spindle #12, #1 M.T.
DRILL PRESSES, Leland Gifford #1MS, 1, 2, 3, 4
DRILL PRESS, #2MS Buffalo Forge single spindle.
DRILL PRESS, #25 Foote-Burt S.S. 24", #5 M.T.
DEEPFREEZE, Cascade 120° F., Industrial Chilling
FILING, #3 Thiel & Sewing, M.D.
GRINDER, Diso, Besley #26S, 18" Dble. End
GRINDER, Arter 18" Rotary Surface.
GRINDER, Cylindrical, Brown & Sharpe #2 Uni.
GRINDER, Oakley #3 Univ. Tool & Cutter.
GRINDER, Sellers #1A Hvy. Duty Tool.
GRINDER, G & L #4 Univ. Tool & Cutter
GRINDER, Heald Rotary #25.
GRINDER, Hydraulic Contour Landis Cam 5"x40".
GRINDER, Cylindrical, Norton 10"x24".
GRINDER, Brown & Sharpe #4 Univ. 12"x60".
GRINDER, Brown & Sharpe Cylindrical #10, 6x18.
GRINDER, Cylindrical, Cinci. 6x18 Filmatic.
GRINDER, Thread, Jones & Lamson #TG-615
GRINDER, Landis Crankshaft 10x32 Hydraulic.
GRINDER, Brown & Sharpe #2 Auto. Horiz. Surface
GRINDER, Heald #72A-3 Internal Size-Matic.
GRINDER, Norton 6x18 Hydr. Vert. Late Type
GRINDER, Pratt & Whitney 14x36 Vert.
GRINDER, Pratt & Whitney 22"x84" Vert.
GRINDER, Springfield #2 Planer Type Surface.
GRINDER, Greenfield #12 Int. Hydromatic
GRINDER, Sellers Carbide 14" dia. wheel, 2" face
GRINDER, #51 Oliver Auto. M.D. Drillpointer.
GRINDER, #33 Abrasive Vert. Auto. Surface.
GRINDER, #2 Cinc. Centerless M.D.



Blanchard #16 High Power Vertical Rotor Surface Grinder

GRINDER, #22 Heald Horiz. Rotary Surface.
GRINDER, #2 Norton Cutter & Tool, late.
GRINDER #1 Moore Jig, Late Type, M.D.
GEAR HOBBER, #3 Barber Colman, M.D.

#49 HEALD Single End with hand cross slide & Univ. Fixture with rotary face plate.

GEAR HOBBER, B & S #34 Spur, 18" dia.
GEAR SHAPER, Fellows #6 High Speed.
GEAR SHAPER, Fellows #12 High Speed.
GEAR SHAPER, Fellows #7 High Speed.

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Hilles & Jones #6 Pyramid Type Motor Driven Plate Bending Rolls. Size—14'x¾" Plate. Top roll—22" dia. Lower rolls—15" dia. Imm. Deliv.

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HAMMER, Bradley 200# Rubber Cushioned Helve.
HEADER, Manville #1 S.S.S.D. Cold, 3/16".
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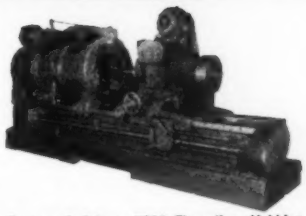
JIG BORER, Linley M.D., hispeed, late type.
KEYSEATER, #5 Mitts & Merrill, Giant, M.D.
LATHE, Sufling Dble. End #VMTS, Devine Bros.
LATHE, Pond 36"x108" Grd. Hd. With Equip.
LATHE, Bridgeford 32"x18' Q.C.G. Grd. Hd.
LATHE, Lodge & Shipley 24"x8' Heavy Duty.
LATHE, LeBlond 24"x14' Q.C.G. Grd. Hd.
LATHE, Hendey 20"x10' Q.C.G., Taper Att.
LATHE, Reed-Prentice 28"x10' Grd. Hd.
LATHE, Lodge & Shipley 16"x8', Q.C.G., Gr. Hd.
LATHE, American 16"x10' Q.C.G., Grd. Hd.
LATHE, American 16"x6' Q.C.G. Grd. Hd.
LATHE, LeBlond 16"x6' Q.C.G. Taper Attach.
LATHE, Lodge & Shipley 16"x8', Q.C.G., Grd. Hd.
LATHE, Hendey 14"x8' Q.C.G. Taper Attach.
LATHE, LeBlond 14"x8' Q.C.G.
LATHE, Hendey 12"x5' Q.C.G. Taper Attach.
LATHE, Lo-Swing 8"x108", M.D., A.C.
LATHES, TURRET, Warner & Swasey Univ. #4 1½".
LATHE, TURRET, Warner & Swasey #3A Univ. Grd. Hd. Bar feed, tooling & collets, AC Motor.
LATHE, TURRET, Simmons #2 Vari Drive 220 V.
LATHE, TURRET, Warner & Swasey #6 Grd. Hd. Ram Type, Bar Feed, Motor in base.
MILL, 2A Brown & Sharpe Horiz. Univ.
MILL, #4B Brown & Sharpe H.D., Horiz.
MILL, #14 Garvin Plain Horiz.
MILL, #0Y Brown & Sharpe Plain Horiz.
MILL, Bridgeport Model #BH, M.D.
MILL, Van Norman M.D. Hand Mill, late.
MOTOR GENERATOR SET, 100 KW Gen. Elec.
MILL, Cinc. Horiz. #2, #3, #4, #5, High Power.
MILL, Cinc. Vert. #2, #3 #4, High Power.
MILL, Sundstrand #0 Hyd. Rigidmill.
MILL, Cinc. 18" Mfg. Type with Vert. head.
MILL, #14 Cochrane-Bly Vert. Duplex Univ. Shaper.
MULT-MILLER, U.S. Tool #MM-1-0, Auto. Prod.
MILL, #30H Sundstrand Two Spindle Hyd.
MILL, #1-M Kent-Owens M.D. Plain Horiz.



Sommer & Adams #20A Threading, Hobbing & Boring Machine, swings 36", 42" centers, 18" cross feed, last use threading breech blocks on 105 MM guns.

MILL, PLANER, Ingersoll 42x36x12, 4 heads.
MILLING MACHINE, Kempsmith #3, Horiz. Univ.
MILLING MACHINE, LeBlond #4 Horiz. Univ.
MILLING, Brown & Sharpe #1½ Horiz. Univ.
MILLING MACHINE, Kempsmith #2 Horiz. Univ.
MILLING, Brown & Sharpe #2 Horiz. Univ.
MILLING MACHINE, Van Norman #2 Duplex.
MILLING MACHINE, Cincinnati #00 Prod., Vert.
MILLING MACHINE, Cincinnati #00 Prod., Horiz.
MILLING MACHINE, K & T #2B, Horiz.
MILLING MACHINE, Nichols Hand Millers.
NIBBLER, #2 Savage Roller Die ⅜"x36" cap.
NIBBLER, Gray Turret Type ¼"x24" cap.
THREADING, Staybolt Lassiter Millholland 1½".
THREAD MILLER, Hansen Whitney 4"x8" Univ.
THREAD MILLER, Lees Bradner #40A Automatic
THREAD MILLER, Plan-O-Mill #3 Planetary Form & Thread Semi-Automatic Milling Machine.
PAPER SHREDDER, #10 Mitts & Merrill, M.D.
PLANER, Gray 30"x30"x10' A.C. Motor Dr.
TAPPER, W & S #1 Sgle. Spdle.
POWER PRESS, Bliss #164 Open Back.
POWER PRESS, Bliss #3A S.S. Dble. Crank Grd. 45 tons, 4" stroke, 36"x24" Bed Area.
POWER PRESS — Bliss - Consolidated #163 - B Straight Side Dble. Crank, 45 tons.
PRESS, V & O #4 O.B.I. 36 tons.
PRESS, Robinson #3 O.B.I. 88 tons.
PRESS, Federal #2 O.B.I. Grd. 2" Stro.
PRESS, Bliss #18, #19, #20, #21, OBI, A.C., M.D.
PRESS, Toledo 59½ S.S. 440 ton cap. 8" str. bed
PRESS, Waterbury-Farrel High Speed 60 tons #3W.
PRESS, 68CBliss Double Action, 3 crank.
WHEEL PRESS, Caldwell 200 tons cap. Hyd.
PRESS, Lucas 15 tons Power Arbor M.D.
PRESS, #6B Whitney Deep Thr. 24", foot.
PRESS, P2, P3 Ferracute M.D. Roll feed
PANTOGRAPH, #1A Gorton M.D. Engraving.
PUNCH, Hecker Turret, 8 station, cap. 2½" hole.
PUNCH, H & J #2 Sgle. End, 24" Thr. 1" thru 1".
PUNCH, H & J #5 Sgle end, 48" Thr. 2" thru 1½".
PUNCH, H & J #6 Sgle end, 72" Thr. 1¼" thru, 1½"
RIVET SETTER, ⅝" cap. Penn, Tubular Rivet & C-P
ROLLS, #1 Buffalo Forge Wrapping.
COLD SAW, Espen-Lucas #700, 48" dia. blade
CUT-OFF SAW, Yates-American #M-90.
SAW, #302 Campbell Abrasive Cut-off.
SAW, #20-C Racine Shear Cut 6"x6" cap.
SAW, NS18-10 Grob Band & Butt Welder.
SAW, Band, Tannewitz #GH-36" High Speed.
SHAPER, 16" American B.G. Motor drive.
SHAPER, 32" Cinc. B.G., Motor driven.
SHAPER, Columbia 32" B.G. Crank.
SHAPER, Morton 36" Draw-Cut, 4-Speed.
SHAPER, G & E 24", high duty, back geared, M.D.
SHEAR, Quickwork #A-1 Rotary 60" Throat, 10 ga.
SPRUE CUTTER, Milwaukee 80 tons, 3½" sq.
SCRAPER & SPOTTER, Anderson Bros., M.D.
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4½" Cleveland Model A Automatic Screw Machine, serial #34486.

36-90 Cincinnati Hydromatic Duplex Milling Machine, serial #3B38D1L-1, late.

#0-8 Cincinnati Vertical Mill, late.

#10 Brown & Sharpe Plain Production Mill, late.

#3VG Reed Prentice Vertical Mill, late.

#14 Cochran-Bly Universal Mill Shaper.

6" Pratt & Whitney Slotter, M.D.

#2 LaSalle Hydraulic Surface Grinder, late.

10"x18" Landis Cylindrical Grinder, late.

Baush Radial Drill and Tapping Machine, late.

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3" Gleason Bevel Gear Generator, late.

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LATE MODEL MACHINE TOOLS . .

AUTOMATICS

No. 61 New Britain, 1¾" cap. 1942.
2" Cleveland, Model A. 1942.
1-1.16" Cleveland, Model A. 1943.

DRILLS

No. B2A Natco Single Spdl. Latest.
16 Spindle Barnes, Hydraulic. 1942.

DRILLS, SENSITIVE

No. 4B-12 Edlund. 1942.
No. 2B-8 Edlund. 1942.

GEAR EQUIPMENT

No. 6 Gleason Revacycle Generator. 1940.
No. 645A3 & 61A Fellows Gear Shaper. 1943.
No. 72 Fellows Gear Shaper. 1942.
No. 7 L.S. Fellows Gear Lapper. 1944.
Pratt & Whitney Gear Grinder. 1942.
8" Red Wing Internal Shaver. 1942.
15" Red Wing External Lapper. 1942.
Red Wing Univ. Gear Checker. 1942.

GRINDERS, CYLINDRICAL

14"x168" Norton Plain Type C. 1942.
14"x48" Norton Type C Pl. Hyd. 1941.
14"x48" Landis Type C Pl. Hyd. 1943.
12"x36" Norton Univ. Type C. 1942.
10"x36" Cincinnati Plain Hyd. 1942.
10"x18" Landis Type C Pl. Hyd. 1942.
6"x18" Landis Pl. 45° Angle. 1942.

GRINDERS, INTERNAL

No. 24-36 Bryant Hydraulic. 1943.
No. 16 CP 16 Bryant Hydraulic. 1942.
No. 16-16 Bryant Hydraulic. 1942.
No. 122 Heald Hyd. Cap. 1940.
No. 18 Heald Plain Hyd. 1940.
No. 75A Heald, Two Motor. 1943.
No. 72A1 Heald Plain Hyd. 1943.
No. 50 Heald Plain Hydraulic. 1943.
No. 104 Rivett Int. & Ext. 1943.

GRINDERS, SURFACE

14"x38" P & W Vertical Hyd. 1942.
No. 22 Heald Rotary, 12" Chuck. 1943.

GRINDERS, THREAD

No. 33 Excello Thread Grinder. 1943.
No. 31 Excello Thread Grinder. 1941.

GUN BARREL MACHINES

No. ½Bx50 P & W Reamer. Latest.
No. ½Bx30 P & W Reamer. Latest.
No. ½Bx50 P & W Rifler. Latest.

LATHES, ENGINE

20"x20' Center LeBlond Heavy Duty. 1941.
18"x60" Reed-Prentice, G.H., M.D.
14"x54" Hendey. 1941.

LATHES, PRODUCTION

No. 3FU Foster Fastermatic Platen. 1942.
No. 4D Potter & Johnston. Late.
No. 3D Gisholt Simplimatic. 1939.
20"x25" Fay Automatic. 1942.
14"x42" Monarch "Magna-Matic." 1941.
10"x12" LeBlond Multi-Cut. Late.
Lipe Carbo-Matic. 1942.

LATHES, TURRET

No. 5 Gisholt Universal. 1942.
No. 4AR Libby Hand Carriage. 1942.
No. 3 Gisholt Universal. 1942.
No. 2 Warner & Swasey Simplified. 1941.

MILLS, PLAIN

No. 2HL Kearney & Trecker. 1943.
No. 3B Kearney & Trecker, M.D.

MILLS, PRODUCTION

No. 2-20 Kent-Owens Hydraulic. 1942.
No. 3A Sundstrand Copy Mill. 1942.
No. 00 Cincinnati Plain Auto. 1942.

MILLING MACHINES, THREAD

6"x36" Lees-Bradner, Model LT. 1942.

WELDERS

Taylor-Winfield Hi-Wave. 1940.

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Cinc. 34-36 Hydo & Mill WHH Tracer Controls Spindle Speeds to 2020 RPM Mfg. 1942

Cinc. No. 2 Medium Speed Dial Type Horizontal Mill Mfg. 1942

Brown & Sharpe No. 12 Automatic Mill 18" Table Travel Mfg. 1942

Norton 16"x48" Hydraulic Universal Grinder with Complete Internal Attachment

Norton 6"x30" Semi-Automatic Cyl. Grinder Electric Cycle Controls & Recip. Wheel Mfg. 1943

Brown & Sharpe No. 2 14"x30" Universal Grinder Complete Internal Attach. Mfg. 1942

Lodge & Shipley 3A 20"x27" CC Automatic Lathe Air Cyl. Air Op Tail Stock Front & Rear Slides Mfg. 1943

Cleveland 3¾" Model A Single Spindle, Automatic with Tooling Mfg. 1943

Cinc. 36" Heavy Duty Univ. Shaper With Power Down Feed Mfg. 1943

Gisholt is Dynetric Balancer Mfg. 1947.

MacDell Corp.

1042 W. Lake St. Chicago 7, Ill.

SOME LATE MACHINES STILL AVAILABLE

BORING MILLS

Bullard 24", VTL New Era
Cleveland 2½" Bar Cap.
Giddings & Lewis No. 8, 3" cap.
Giddings & Lewis No. 32, 3⅜" cap.
King 42" Vert. 2 rail heads
Niles-Bement-Pond 4" Bar
Niles-Bement-Pond 4½" Bar
Niles-Bement-Pond 60" Vert.

DRILLS AND RADIALS

Bausch Multi-spindle
Bausch Radial Drill & Tapper
American 6'x15" Univ.
Buffalo #2 Motor Spindle
Cincinnati Bickford 6'x13" col.
Foote-Burt #25
Walker-Turner Radial. 2½'
Leland Gifford 2LMS (2)
Natco Multi-spindle

ENGRAVERS

Auto Engravers Bench Type
Deckel GK2 Type 3 Dimensional, New
Gorton #1A, 1D, ME
Gorton #3B 3 Dimensional

GEAR EQUIPMENT

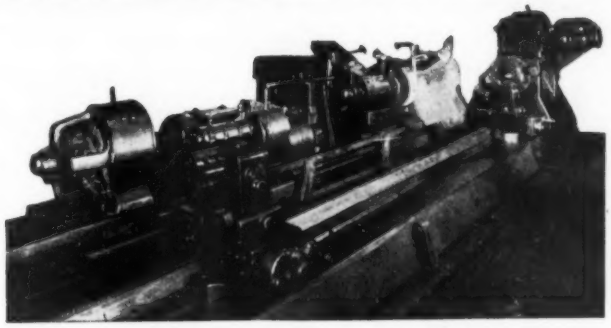
Barber-Colman #3
Barber-Colman #12 Hobber (2)
Fellows High Speed Shapers 712, 72, 725, 71
Flather 72" Cutter
Gleason 3" Straight Bevel Generator
Gleason #4 Angular Bevel Tester
Gleason #2 Surface Hardener
Gould & Eberhardt 36" Cutter
National Broach Red Ring Lapper, Shaver
Schuchardt & Schutte #1 Hobber
Fellows #20M Redliner

GRINDERS, MISCELLANEOUS

Bryant #5 Internal
Covel #91A Univ. Tool & Cutter
Greaby Int. 1G-12, G2
Heald #73 Internal centerless
Heald #81 Internal Gagematic
Heald 72A3 Int. Centerless Sizematic, #1 Tool
Landis 12"x36" Univ., Latest
Landis 6"x39" Type C Cyl.
Majestic Internal
Norton 6"x30", 10"x18" Type C cyl.
Norton 16"x48" Type C Univ.
Norton Roll Grinder 50"x28'
Oliver #510 Drill Pointer, Sellers 4G
Port Cable Belt WG8
Pratt & Whitney Contour
Pratt & Whitney Radius #R6, K.O. Lee Tool
Van Norman #666 Crankshaft
Vernon Tool & Cutter
Wicaco Internal

GRINDERS, SURFACE

Abrasive 3B 8x24", #33, #34 Vert.
#10 Blanchard 16" Chuck
Blanchard #16, 30" Mag. Chuck
Brown & Sharpe #2 Mag. Chuck
G & L #43 12"x24" Hyd. Feed, #5, 10"x36"
Heald 22—12" chuck, Arter 12"
Norton 6"x18" Hyd.
Pratt & Whitney 12x36" Vert.
Reid 11x36 Motor in Base



Norton Roll Grinder 50" x 28' (actual photo)

LATHES

Lodge & Shipley #3 Duomatics
Hardinge Precision 9", 1" Collet Cap., Rivett
Hendey 12"x42" Geared Head Late
Hendey 14" Yoke Head Lathes
LeBlond Regal 10"x3' bed
Lipe-Carbo 12x18" (2)
Monarch 10"x20" EE Latest
Monarch 12"x30" CKK Late (2)
Putnam 36"x22'
Putnam 42"x17'
Sebastian 12"x4' G.H.
Wickes 32"x35' Geared Head
Reid Small Piece #9WSL
Sundstrand 8x15"
Sundstrand 15" Stub

MILLS, PLAIN, UNIVERSAL & PROD.

Archdale Plain, 14", Prod.
Brown & Sharpe #000, 21
Burke #4 Plain & Univ.
Cinn. 08 Plain
Cinn. 1-12 Mfg.
Cincinnati 1 M Univ.
Kent Owens 1V, 1M
Milwaukee #2B, 3B, Plain & Univ.
Simmons Micro-Mill
Sundstrand 0,00 Rigidmil
6"x20" P&W Thread Mill
Van Norman #2 Universal

MILLS, VERTICAL

Brown & Sharpe #3 single pulley drive
Cincinnati #4, 00 Vert. #2, 3, SPD
Morey #12M Profiler, 2 sp.
Pratt & Whitney Profiler 12B, 2 SP

PRESSES

Bliss 304A 4" Str.
Bliss 643, 650 Hi-Production Presses
Bliss 18, OBI, 58, 62, 162 OB
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #78½, 330 Ton, SS, Bliss 74½
Bliss 3½A Double Action Toggle
Ferracute EG54, 400 Ton Knuckle
Niagara Herning, 15 Ton
Niagara A1¾, O.B.I.
Toledo 400 Ton Knuckle Joint #663
Toledo 29 Double Action Cam
V. & O. #102 O.B.I. Reducing

TURRET LATHES

Acme 6W Fox 2 9/16" Cap.
Brown & Sharpe, #1, 2 Hand, #10, 11
Denver, 6, 2" Shell Turret (3)
Foster #3B 4½" Cap.
Gisholt #4 Bar, Feed, Late.
Jones & Lamson 2½" Saddle Univ. Late
Morey #2G Late
Oster 601 WD. #2 Simmons Microspeed
Warner & Swasey #1A, 2A
Warner & Swasey G.H. #5 Univ., Late
Warner & Swasey #2, Late

HYDRAULIC EQUIPMENT

SELF CONTAINED PRESSES

500 ton Shaft Straightener 24' Long Bed Watson Stillman
125 Ton Southwark Press, Bed 96"x30" 30" stroke, 2 to 4 ft. opening
80 Ton Wilson Press, 51"x24" Platen, 11½" St. 13" opening
50 Ton William & White, 20" St. 54"x 20" Bed—24" opening

MISCELLANEOUS PRESSES

300 Ton Watson Stillman 24x20" Platen 11" St. 21" opening

All Hydraulic Equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your Hydraulic problems.

NEW IN STOCK

Air Hydraulic Presses — Arbor Presses #6C Famco — Band Saws Kalamazoo — Famco 6x12"—Drill Presses all sizes—Hydraulic Press Northern 20 Ton—Injection Molders, 1 ounce—Power Presses, OBI, 1, 4, 4½, 5, 7½, 10, 15, 20, 30 ton —Shaper 7" Amco, 8" Shaperite—Shaper Sheldon 12"—Shears, Foot 22" to 8', 16 & 18 ga.—Shears, Power 3'x18 gauge to 10' x 10 ga.—Welders, Arc, Seam, Spot all sizes—Vert. Milling Attach. Halco H.S. Motors Grinders, Buffers, all sizes.

MISCELLANEOUS

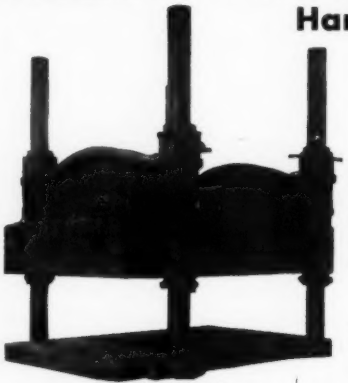
Automatic, Cleveland Model B 1 1/16"
Automatic B & S #00G
Automatic 4 Sp. 1½ Conomatic
Band Saw: DoAll Zephyr 36"
Band Saw: #8 Marvel
Filers—DoAll Band Filer
Filers—Grob Band Filer
Hacksaw: Peerless 6"x6"
Hacksaw: Racine 10x10" Hyd.
Honer: Micromatic #H-1
Keyseater: Davis, Baker, M & M
Shapers: 24" Rockford, 24" Cinci., 28" Gould & Eberhardt. Many Others
Tappers: #1 Bakewell, #3C Haskins
Vertical Shaper: Pratt & Whitney 6" Model "B" 1941
Welder: 50 KVA Eisler Air Operated
Welder: Taylor-Winfield 50 KVA HI-Wave

This is but a partial listing. Write for free Catalog. Inquiries invited. HUNDREDS OF OTHERS

AARON MACHINERY CO., Inc., 45 Crosby Street, New York 12, N. Y.
"CABLE—AARMACH N. Y." Telephone WOrth 4-8233

MANY ATTRACTIVE "BUY"S in

Hard-to-Find HEAVY MACHINERY and SHEET METAL EQUIPMENT WELL-WORTH INVESTIGATING!



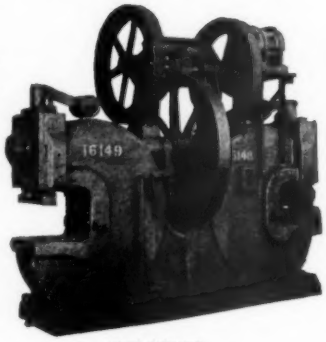
actual photograph
MACKINTOSH-HEMPHILL 30" strk
(upward) Hydr. Press

POWER PRESSES

TOLEDO #88, 16" stroke
BETHLEHEM STEEL Hydr. flanging (downward) cap 1200 ton; 66" strk
MACKINTOSH-HEMPHILL hydr. (Upward) 60" stroke; intensifier
BETHLEHEM 16" stroke hydraulic
MACKINTOSH-HEMPHILL 4-post hydr., 24", 36", 60" strokes

PUNCHES—MULTIPLE

SOUTHWARK 400 ton, 7" stroke
WILLIAMS & WHITE, 6" str. Vert.
CLEVELAND #1, 6" stroke
HILLES & JONES #3 Vertical
MASSILLON #5, 60" stroke



actual photograph
LONG & ALLSTATTER Size
B Vertical Punch

ALSO AVAILABLE

CAR WHEEL BORING LATHE—BETTS-CONSOLIDATED
AXLE LATHE—NILES TOOL WORKS
FORGING MACHINES—FORGING ROLLS—AJAX
HAMMERS—Forging, Steam; ERIE, CHAMBERSBURG
and many other machine tools and Sheet Metal Equipment

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McKEES ROCKS INDUSTRIAL ENTERPRISES

Nichol Av. **PHONE FEderal 1-0746** **McKees Rocks (Pittsburgh) Pa.**

MUST MOVE PROMPTLY FROM LOCAL CUSTOMER'S PLANT

BEMENT MILES 18" SLOTTER with 3" dia. spindle. M.D.

GOULD & EBERHARD 36" Gear Cutter M.D.

BROWN & SHARPE #5—48" Gear Cutter, M.D.

BINSEE MACHINERY COMPANY HORIZONTAL BORING MILL. Table 30"x64". Quantity of boring bars.

CINCINNATI 60"x48"x14' Planer. 4 heads. 1 extra side head on massive floor stand for open side work. M.D.

B & O #2 Turret Lathe 1" Cap. M.D.

AMERICAN 20"x16' QUICK CHANGE GEAR LATHE. M.D. Old, but good.

BARNES HEAVY DUTY 26", 4-SPINDLE DRILL. 1 spindle for tapping M.D. #4 M.T.

GRINDERS—CYLINDRICAL. B & S #11. 7"x 32". Plain Grinder. Table swivels. Motorized with 4 motors.

LANDIS 10"x36" Plain, M.D. Also Planer type Grinder 16"x36".

"BEMENT" 26" STROKE TRAVERSING HEAD SHAPER. 48" travel to ram. 2 tables. (PLANER SHAPER)

THE OSBORNE & SEXTON MACHINERY CO.

P. O. Box 88 **Columbus 16, Ohio**

ANGLE ROLLS, 2"x2"x¼" H. & W., '42
AUTOMATIC, #2G Brown & Sharpe 1¼" 1942
BOLT THREADER, 1½" Williams Reliance
BORING MILL, 100" Cinci. Massive, 2 Hds., M.D.
BORING MILL, 72" N.B.P., P.R.T., M.D.
BORING MILLS, 3½" & 4" bar Landis Floor (3)
4½" bar Niles table, Dual Control, 3" bar Univ.
BORE-HONE, Barnes, 10 stroke, 6" bore, '42
BRASS LATHE, 21" Acme, Late, Hardened Ways
DRILLS, 21" Royersford-Excelsior New & Used
DRILL, 25" Weigel, Tapping, M.D.
GEAR GENERATOR, 3" Gleason, Late
GEAR HOBBER, 36H Gould & Eberhardt
GEAR HOBBER, #12 Barber Coleman
GEAR PLANER, "II" Rianochar, Bevel
GEAR SHAPER, No. 75 Fellows High Speed
6IA, 6I, & 64A, 6 Fellows
GRINDERS, 20"x120" Landis, Cyl., Hyd., AC
GRINDER, 10"x48" Cinci., Cyl., M.D.
GRINDER, No. 6-T Sellers, Tool, '42
GRINDER, No. 16Y2B Bryant, Int., 1943
GRINDER, No. 174 Heald Gap, Int. 54" ov., '42
GRINDER, No. 72AS Heald Internal, 1943
GRINDER, Micro-Internal, Large
GRINDER, SURFACE, 14"x36" P. & W.
GRINDER, SURFACE, 13"x48" Hansott Vert. Spin; No. 18 Blanchard, 26" Chuck
GRINDER, UNIV. 12"x30" Thompson M.D.
LATHES, 48"x20'6" con. Simmons, like new '42
LATHE, 42"x31' con. Putnam Grd. Hd.
32"x25' con. Sommerfeld, 2 T.A., 2 carr., '42
22"x245/8"x48" con. Skoda, New
20"x48" con. American, T.A., (2)
14"x8' Hendey T.A., M. In base
16"x12"x6' Hendeys (2)
16"x10' bed Sidney Monotrol, T.A.
25"x18' Bed LeBlond Grd. Hd., M.D.
TAPPERS, Nos. 1 & 2 Bakewell (4)
TURRET LA., No. 3AL Gisholt, 6¼" hole in spin.
2#" Libby "C" 4½" capty.
No. 1B Foster Univ., 2" capty. (2)
No. 2B Foster Univ. 3¼" capty. Bar.
THREAD MILLER, 12"x60" Morey Shields, '42
MILLER, UNIV. No. 2A B. & S., M. In base, Timken Nos. 2 & 3 Cinci. Pl. Cone Motorized
MILLERS, HORIZ. No. 4 Cinci. High Power
MILLER, HORIZ., No. 2 Heavy K.&T., M.-In-base
PIPE THREADER, 2" Landis, AC. M.D.
PLANER, 48"x36"48" Cinci. 4 Hd., Box, PRT, Force Feed
RADIAL DRILL, 7'10" col. Amer. Trip. Purp M.D.
SHAPER, 24" Stockbridge, gear box M.D.
SHAPERS, 24", 20" & 16" G & E., AC, M.D.
22" & 16" Hercules, Univ., New
36" Morton, Draw-Cut M.D.
SLOTTERS, 20"—24" & 10"—12" Dills, M.D.

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375 Allwood Road, Clifton, N. J.
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ALL LATEST TYPE

FARNHAM BENDING ROLLS

FOR AIRCRAFT

Model #638 Age 1942 Cap. 6'x3/8" radius x 1/32" aluminum.

LIKE NEW

Turrets (2)—W & S #2 Chuckers

Turrets (4)—W & S #2 Bar F

Turrets (1)—W & S #2 Bar F & Power F, 2 Turret

Hisgen Injection Molding Machine

6 ounce capacity, manufactured by Hisgen Machine Tool Works, Los Angeles; Late type, 10" diameter ram 7½ H.P. Motor G.E. 3 60 220-440 1155 r.p.m. panel control board, condition like new, used little.

KINGS COUNTY MACHINERY EXCHANGE

408 Atlantic Ave., Brooklyn, N. Y.
TRiangle 5-5237—Dept. "A"

FOR SALE

No. 10 Inclined Waterbury-Farrel Thread Roller.

AMERICAN SWISS PARTS CO.
245 So. Schaefer Hwy. Detroit 25, Mich.
Tel. WARWICK 8-7050

Latest Types — Guaranteed Machine Tools 1941-1950 Models

BROACHING MACHINES

CINCINNATI: 2-36 Vertical Broach, 2 ton, 36" stroke

CAM MILLERS & GRINDERS

VAN NORMAN: Contour Miller 10CT

DRILLING MACHINES

ALLEN: #2 High Speed, 15" overhang
BARNES: 2014 2-spindle on 3-spindle base
BAKER: 217 Upright Heavy Duty, 2" capacity
FOSDICK: No. 4BM Upright, High Speed, 7/8" drilling capacity, 12" overhang
PROVIDENCE ENG: FV-6 Sensitive 6 motor-driven spindles, 3/8" capacity
PRATT & WHITNEY: 1/2" x 60 Deep Hole Reaming Machine
ARCHDALE: Radial, all sizes (New)

ENGRAVING MACHINES

DECKEL type—3 dimensional (New)
GORTON: 3U & 3Z, 2 dimensional
GORTON: 3B, 3 dimensional

GEAR CUTTING MACHINES

BARBER-COLMAN: No. 3 Hobber
BROWN & SHARPE: No. 6 Gear Cutter, 72" diameter, 1¾ D.P. capacity
FELLOWS: 61A Shaper, 18" dia. capacity
FELLOWS: 64A Shaper, 18" dia. capacity
FELLOWS: 72 Shaper, 7" dia. capacity
FELLOWS: Straight Line Generator, 3" dia. with many cutters
GLEASON: #12 Rough & Finish Generator
GLEASON: 3" Straight Bevel Gear
HAMILTON: No. 1 Hobber, 6" diameter
SYKES: Gear Shaper 14" external, 20" internal
SYKES: Rack Cutting Machine 24" long (New)

GEAR AND SPLINE GRINDERS

PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
GEAR GRIND MACH: GG-19, 10"x24" Hydr. Spur Gears and Splines, also internal
GLEASON: No. 17 Spiral, Zerol & Hypoid, capacity 23½ P.D.

GEAR FINISHERS & TESTERS

FELLOWS: 8LSI and 18LSI Gear Lappers. External & Internal Spur and Helical
FELLOWS: No. 12-C Spacing Tester
GLEASON: No. 4 and No. 8 Bevel Gear Testers, Hand and Power Operated
GLEASON: 3" Bevel Gear Tester
NATIONAL BROACH: SIC—12" Red Ring Tester

GRINDERS—CYLINDRICAL

BROWN & SHARPE: No. 23, capacity 10"x 48", plain
BROWN & SHARPE: No. 10 capacity 6"x18" plain.
CINCINNATI, 6"x18" Hydraulic, plain
CINCINNATI: 10"x36" Hydraulic, plain
LANDIS: 18"x32" Type "D" Crankpin, Hydraulic, for grinding crankshafts
NORTON: 6"x18" plain, hydraulic
NORTON: 10"x18" plain, hydraulic
NORTON: 10"x18" 45° angle wheel head
VAN NORMAN: #66 Crankshaft Regrinder

GRINDERS—GEAR & SPLINE

PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
GEAR GRIND MACH.: GG-19, 10"x24" Hydr. Spur Gears and Splines, also internal
GLEASON: No. 17 Spiral, Zerol & Hypoid, capacity 23½ P.D.

GRINDERS—INTERNAL

BRYANT: No. 5Y Internal
BRYANT: 112 Universal, Hydraulic
BRYANT: 18C16 Hole, Hydraulic
HEALD: 70A Plain, Internal
HEALD: 72A3 Plain & Univ.
HEALD: 72A5 Plain & Univ.
HEALD: 72A3 Sizematic Centerless
HEALD: 72A5 T-bed, Universal

GRINDERS—RADIUS

VAN NORMAN: #73, capacity 7½" diameter
VAN NORMAN: #639, capacity 7" diameter
VAN NORMAN: #649, capacity 8" to 16" diameter
VAN NORMAN: No. 3½ Universal

GRINDERS—SURFACE

ARTER: A-1—8" Rotary
ARTER: A-3—12" Rotary
HEALD: 8" Rotary
HEALD: No. 22 Rotary—12" Chuck

GRINDERS—THREAD

EXCELLO: No. 31 external, dia. 5"x18" centers
EXCELLO: No. 33 external, dia. 6"x18" centers
JONES & LAMSON: TG-1245 External, 12" dia. x 45" centers, with additional capacity if required

HONING MACHINES

BARNES: No. 306H Vertical, 24" Stroke
MICROMATIC: H-510 Double End Horizontal
MICROMATIC: H-2 Single End Horizontal, 2-spindle, ¼" to 1" dia. capacity

LAPPING MACHINES

FELLOWS: 8LSI and 18LSI Gear Lappers
NORTON: No. 28 Hyprolaps
NORTON: 2F x 40" Diameter
SCHRANER: Model A External Cylindrical Lapper—4 heads

LATHES—PRODUCTION

LIPE-ROLLWAY: 12"x30" Carbomatic, hydraulic feed
LODGE & SHIPLEY: No. 3A Duomatic
MICHIGAN: #1700 and 1712 Relieving
MONARCH: 24"x60" Geared Head
BLOUNT: HB Polishing, 12"x48"
WILLSON: 15"x48" Geared Head Motor Driven (New)

LATHES—TURRET

GISHOLT: #2L Saddle Type, Extended bed, 24" extra length
HERBERT: #8 for chuck work, 20" swing (New 4 machines)
HERBERT: Turret Lathes, all sizes (New)
WEBSTER & BENNETT: Vertical Turret Lathes, 36" and 60" dia. (New)
WARNER & SWASEY: 2A, Saddle Type

MILLING MACHINE

BRIDGEPORT: Vertical Miller, PF
CINCINNATI: 2-spindle Vertical Hydrotel with two rotary tables of 36" dia.
SUNDSTRAND: No. 0 Rigidmil
TAYLOR-FENN: M-80 Duplex Spline
TAYLOR-FENN: Vertical 6"x21" table with power feed, high spindle speeds
RICE-BARTON: Duplex Spline
VAN NORMAN: Contour Miller 10CT

SAWS & CUT-OFF MACHINES

MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
RUSSELL: 9¼" cut-off Saw with Auto. Stock Feed (New) Hydraulic
CAMPBELL: No. 425 Cutalator Abrasive Cut-Off, 4¼" dia. capacity
WILLIAMS: 10" Pipe & Tube Cut-Off

THREAD MILLERS & TAPPERS

HALL PLANETARY: Model "D" Thread
LEES-BRADNER: LT 6"x36" Thread
LEES-BRADNER: 40A Thread Miller
MURCHEY: No. 22 Tapper, Horizontal, ½" to 2½" dia. capacity
NATCO: Vertical Tapper 18 spindle
PRODUCTO: Hand Tapper

TOOL SHARPENERS

OLIVER: 3A Face Miller Grinder
OLIVER: 18" Tool Bit-Template
FELLOWS: Flat Top Helical Gear Cutter
RANSOM: 2-Wheel Grinder 3 HP
RUSSELL: 40" Saw Sharpener (New), Automatic Indexing

MISCELLANEOUS

CUT-OFF: Campbell, Abrasive 425 Cutalator, 4½" dia. capacity
CUT-OFF: Pipe & Tube, 18" Williams
LATHES: Blount Polishing 12"x48"
PRESS: Screw, Gen. Elec. 3 ton
RACK CUTTING MACHINE: Sykes 24" long (New)
RIVETER: Gen. Engr. 24" throat
TEST STAND: Denison 918-AM Hydraulic
PUNCH SHAPER: Sentinel Shrewsbury (New)

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Machine Tool Engineers since 1919

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UNUSUAL BUYS WITH GUARANTEED PERFORMANCE

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AMERICAN

48"x20' Geared Head, 10" centers, 2⅝" hole thru spindle
36"x40' Internal Face Plate Drive, 33' center distance, 16 speeds
30"x32', 12 speed head
30"x12', Geared head
24"x8', geared head
18"x8', geared head
18"x8', 3 SCD bowl head, back geared
18"x8', Geared head
16"x10', Geared Head, 12½' centers, 1¼" hole thru spindle
16"x8', High Duty, 3 SCD
16"x8', 3 SCD, Bowl head type
16"x6', High Duty, Cullman Drive
16"x6' Geared Head, 1¼" hole thru spindle, 12 speed

LODGE & SHIPLEY

27"x18', Patent head
24"x12', Selective geared head
20"x10', 5 SCD
20"x8', geared head
18"x9', Bowl head type, 3 SCD
18"x8', 5 SCD, single back geared
18"x8' Selective Geared Head, 1-9/16" hole thru spindle
18"x8', Selective geared head
14"x6', 3 SCD, double back geared
14"x5', 5 SCD

LeBLOND

36"x14' centers, 20 HP V-belt drive, late type, 16 spindle speeds
24"x10', 3 SCD, double back geared
21"x8', 3 SCD, double back geared
17"x8', 3 SCD, double back geared
14"x8', 4 SCD, single back geared
#6 Multi Cut, swings 9"

HENDEY

18"x8', 4 SCD
14"x8', Model EBN geared leg
14"x5', 4 SCD, Yoke head type, drive all drive
14"x6', 4 SCD, Yoke head type

MONARCH

16"x8', 3 step conedrive, double back geared, motor drive unit
16"x8', 3 SCD, double back geared
18"x6', Motor on leg type
14"x6', 3 SCD, double geared
12"x30" centers Monarch Model CK Tool Room Lathe, latest type

BOYE & EMMES

20"x8', 3 SCD, double back geared
18"x8', 3 SCD, double wall apron
Landis 10x24 Type "C" Univ., LATE TYPE
Gardner 24—53" Horiz. Disc Grinder
Micro Model FG Grinder
Bryant #3 Hole Grinder
Heald #78 Centerless Grinder

Three—Cincinnati 6 x 18 Cylindrical Grinders, Model ER, NEW 1943, Complete with Infeed and preciprocator attashment.

Libby Geared Head Turret Lathe, 24" swing, 4½" hole, 6 position turret, 4 jaw chuck
Gray 32x32x8', 1 rail head, hand elevation, cord housing
Style D Hall Planetary Miller
Morey 26 Plain Turret Lathe
Niles Bement Pond 84x22x14' bed, reversible DC drive, 2 rail and 2 side heads
Cleveland Openside Planer, 26x26x8', motor drive thru gear box
Cincinnati Double Housing Planer, 24x24x6', 1 rail head, plain table
Gray Double Housing Planer, 42"x42"x12', latest type, new 1944, box bed

BORING MILLS—VERTICAL

Colburn 54", Two heads on rail

MILLERS—PRODUCTION

Ingersoll 42x30x12', 4 head adjustable rail
Ohio 40" Tilted Rotary Miller

MILLERS—PLAIN

Cincinnati #3, 3 SCD, double back geared, single — round overarm
Cincinnati #4 HI Powered, single pulley drive, single round overarm
Brown & Sharpe #5B, single pulley drive, single round overarm

MILLERS—UNIVERSAL

Cincinnati #3, 3 SCD, with Reeves drive
Cincinnati #3 GH
Brown & Sharpe single pulley drive 3A
Milwaukee 3B, 18 speeds

GUARANTEED MACHINERY

Cincinnati Machinery Co., Inc.
219 East Second Street
Cincinnati 2, Ohio

ABRASIVE CUT-OFF: #212 Campbell, 2" bar cap. coolant pump, 7½ HP, M.D., 1943
AUTOMATIC: ⅝" Coco, Swiss Type, M.D., Late
AUTO CHUCKER: 8½"x8" Goss & DeLeeuw, 4 Sp.
CHIP WRINGER: ¾" BU, Barrett-Nat'l., M.D.
DIEING PRESS: 25-Ton Henry & Wright, Reeves Drive, Madison-Kipp Oiling, 1942
DRILL: 4 Sp. Kingsbury Ver., No. 8 heads
DRILL PRESS: MA-2 Avey, 24" swing, 1942
GRINDER: Sterling Univ. T&C, 1944
GRINDER: #6S Gallmeyer & Livingston, Hydraulic, 12"x48" Magnetic Chuck
GRINDER: No. 72A5 Heald Plain, 1943
LATHE: 12"x54" LeBlond HG, G.H., 1943
LATHE: 14"x30" Bradford, Taper, 1941
MILL: No. 0 B. & S. Omniversal, 1940
MILL: No. 000 B. & S. Elec. Prod. 1941
MILL: No 5B Heavy B. & S. Plain, M.D.
RADIAL DRILL: 4'x11" Cin.-Bickford, Gearbox
SANDERS: No. AG8 & G8 Porter-Cable
SHAPER: 36" American V-Ram, Auto-Oiled

BARRON MACHINERY COMPANY
113 S. Clinton St. Chicago 6, Illinois

Oliver Floor Type Filing Machine.
No. 6 Whitney Hand Mill.
Putnam 18" Vert. H.D. Slotter, M.D.
Hanna 80-ton Yoke Riveter, 75" reach.

D. E. DONY MACHINERY CO.
47 Laurelton Rd., Rochester 9, N. Y.

Surplus Bearing Stock For Sale

536 Complete Sets Torrington Bantam Bearings. Inner Ring #566832. Outer Ring #6883122. Have 3½" inner diameter and are 2" wide. All Sets still in original boxes.

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426 West 33rd St., New York 1, N. Y.

LEAF BRAKE

12'x1¼" DREIS & KRUMP. AC MOTOR DRIVE.

WEST PENN MACHINERY COMPANY
1210 House Bldg. Pittsburgh, Pa.

POWER PRESSES

BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED

MONA

JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

LATE TYPE NOLL REBUILT MACHINE TOOLS

AUTOMATICS

5½" Cleveland 4-Spindle Chucker
6x6¾" Goss & DeLeeuw

BORING MILLS Horiz. & Vert.

8" Bar Niles Horizontal Floor Type
32" Bullard Vertical
36" Bullard Vertical
42" Cincinnati Vert. Rapid Traverse
42" King Vertical
100" Niles Vertical, Rapid Traverse

BROACHES

5-Ton Oilgear #2 Twin Ram Horiz. 36" Str.
30-Ton American V-48—40" Stroke

DRILLS & RADIALS

S.S. Edlund No. 2B—8" No. 3 M.T.
S.S. Barnes 20", #3 M.T.
S.S. Cincinnati 22", #4 M.T.
6'17" Column Carlton Radial Drill
9' Arm Ridgway Rail Drill No. 5 M.T.

FURNACES

22 KW Westinghouse Molten Lead Bath Cly. Hardening 1600°
50 KW Tocco Induction Heating Unit

GEAR EQUIPMENT

No. 6-60 Brown & Sharpe Gear Cutter
15" Gleason Hypoid Generator
18" Gleason Hypoid Gear Lappers

MILLS

No. 1 Kempsmith Plain Horizontal
No. 000 Brown & Sharpe Plain Production
24" Cincinnati Duplex Production
28"x33" Ingersoll Horiz. Slab Mill
Hall Planetary Type "C" Thread Mill

SHAPERS

6" Pratt & Whitney Vertical
30" Morton Horizontal Draw Cut

GRINDERS

20x48" Van Norman Crankshaft Re-Grinder
14"x96" Norton Type "A" Cylindrical
14"x60" Brown & Sharpe No. 4 Universal
18" Double End Besly No. 205 Disc Grinder
26" Double Opposed Gardner No. 84
36" Rotary Disc Grinder, Besly No. 342
No. 12 Bryant Flange Type Work Spindle
30"x160" B.C. Labbell No. 3GH Roll Gr.
10"x18" Fitchburg 30° Ang. Spline Grs.
8"x24" Abrasive No. 33 Vert. Surf. Gr.
8" Arter Surface Grinder
12" Heald No. 22 Rotary Surf. Grinders
8"x48" Jones & Lamson Thread Grinder
No. 31 Ex-Cell-O Precision Thread Grinder

LATHES

171" BC Lodge & Shipley No. 3A Duomatic
5"x24" Seneca Falls Model "U" Lo-Swing
Coulter Threading Lathe
Foster Turret 2¼" Hole in Spindle
Gisholt Turret, 6¼" Hole in Spindle
#3A Warner & Swasey Turret Lathe
#4 Warner & Swasey Turret Lathe
20" Bradford Turret Lathe
21"x7' LeBlond G.H. Eng. Lathe with T.A.
24"x10' American Engine Lathe

PRESSES

71½ Ton Toledo No. ½ OBI
No. 52 S.S. Toledo Bed 27½x28", 3" Stroke
100-Ton HPM Hyd, Bed 18x18", 12¼" Stroke
No. 14 Niagara Horn

TRUCKS

3000# Mighty Midget 30" Fork, 72" Lift, Gas
6000# Clark 84" Platform, 6" Lift, Gas

MISCELLANEOUS

#307-B Barnes Hone—Late
Centering Machine—Simplex—Double End
Header, 150-Ton Manville ½x8" Capacity
Hone, Micromatic Horiz ¼-1" dia—¼x6" lgth.
Punch & Shears: ¾"-1"-1¼"-1½"
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Superfinisher, Foster 4"x18"
Tappers, Garvin No. 2 and No. 2X

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56"x18' CMC Heavy Duty Lathe, 24 speed geared head, power rapid traverse, 30HP AC motor

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100" BERTRAM (Niles Patterns) Vertical Boring Mill, 2 heads on rail, rapid traverse

No. 3 VAN NORMAN Plain Horizontal Knee Type Milling Machine, rapid traverse, coolant pump, arbors, new 1942

No. 18-48 KEARNEY & TRECKER Duplex Production Mill, 1942

No. 2D KEARNEY & TRECKER Rotary Head Die Miller, cherring attachment, right angle milling attachment, slotting attachment, rotary table, measuring rods, new 1943

12"x24" NORTON "Multi-Purpose" Universal Grinder, internal attachment, 1943

No. 10 BROWN & SHARPE Tool Grinder, 1943

6"x18" NORTON Hydraulic Surface Grinder, Magnetic Chuck, 1941

8"x24" ABRASIVE Hydraulic Surface Grinder, magnetic chuck & wet grinding attachment, 1943

16" HENDEY Crank Shaper, factory motor drive, vise

JONES & LAMSON 14" Pedestal Type Comparator, with attachments, 1942

No. 2 AVEY Single Spindle Drill, No. 2 Morse taper, Aveymatic power feeds, coolant pump, new 1942

No. 4BM FOSDICK Single Spindle Drill, No. 3 Morse taper, 1942

No. 7125A FELLOWS High Speed Gear Shaper, change gears 1943

No. 5 JOHNSON O.B.I. Press, new 1944, 55 tons

25A HEALD Rotary Surface Grinder, 24" diameter, magnetic chuck

V-6-24 COLONIAL Broach, 6 ton, 24" stroke, 1947

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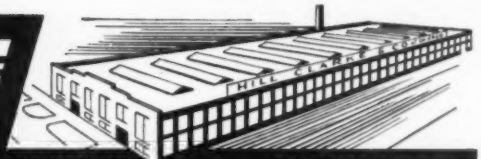

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AUTOMATICS

1-1/16" Model A Cleveland (1942)

DRILLS

1 Spdl—26" Sw—No. 2 LMS L.G. Hyd.
2 Spdl—24" Sw—No. 2 Aveymatic
6 Spdl—14" Sw—No. 2 LMS L.G. Hyd.
1-Spdl—2¼ Colburn, No. 5 Taper
D-31 Fox Multiple Drill

GEAR MACHINES

No. 12 HS Gould & Eberhardt Hobber
No. 12-H Gould & Eberhardt Hobber
11" Gleason Bevel Gear Generator
No. 1 Whiton Auto. Gear Cutter
No. 6 Gleason Bevel Gear Tester (1942)
No. 36-BM G & E 8 Spdl. Rougher
No. 65 Fellows—Cone Dr.

BORING MACHINES

21" Lucas Hor. Bor. Mill.
Rockford—3¼" Bar
42" N-B-P Vert. Bor. Mill.
72" Niles—Hvy. Pattern

GRINDERS

4"x18" Landis, Model 4H
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"x36" Norton Type C (1943)
10"x72" Landis Type C Hydraulic
Hill-Clarke Norton Type Motor Driven Grinders
10"x36" centers
10"x50" centers
10"x72" centers
10"x96" centers
14"x36" centers
14"x72" centers
16"x120" centers
16"-40" gap x 120" centers
18"x96" centers
18"-30" Gap x 96" centers
20"x96" centers
24"-32" Gap x 144" centers
26"x72" Norton Crank Shaft Grinder
15"x15"x8' Norton Surf. Gdr.
No. 25-A Heald Surface Grinder
No. 72-A-5 Heald Internal (1942)
No. 16-16 Bryant Internal Grd.
No. 16-28 Bryant Internal Grd.
No. 24-26 Bryant Internal Grd.
No. 81 Heald Centerless Internal
No. 74 Heald Internal Centerless

LATHES

14"x6' Walcott Lathe
19"x8' Le Blond Hvy. Duty Lathe
20"x9' Chard Lathe
36"x18' Putnam Grd. Hd., M.D.
No. 4 Warner & Swasey Tur.-Bar Fd.
No. 5 B & O Tur. Lathe, Cone Hd.
No. 6 Warner & Swasey Tur.-Bar Fd.
2¼"x24" Jones & Lamson
No. 2A Warner & Swasey s.p.d.
No. 3A Warner & Swasey (1941)
20"x8' Fay and Scott
18" Libby Tur. Lathe, M.D.
21" Gisholt, M.D.

MILLING MACHINES

No. 08 Cincinnati Plain
No. 08 Cincinnati Vert.
No. 3 Sundstrand Rigidmil
6"x36" Lees-Bradner — Model LT (1943)
6"x80" Pratt & Whitney Thrd. Mill
6"x132" Pratt & Whitney Thrd. Mill
6"x168" Pratt & Whitney Thrd. Mill
10"x48" Hanson-Whitney Thread (1942)
10"x60" Pratt & Whitney Thrd. Mill

MISCELLANEOUS

No. 151 Besley Dbl. End Disk Gdr.
24" Lutter & Geis Shaper
15" Dill Slotter
18" Dill Slotter
38" Morton Draw-Cut Shaper (1945)
18" Newton Slotter
No. 0 Bakewell Tapper
Baush Radial Tapper
No. 307 Barnes Hone
Model 200 Micromatic Horiz. Hone, 1 Spdl.
Model H-2 Micromatic Horiz. Hone, 2 Spdl.
Model 200—H5 Micro.—Horiz.—2 Spdl.
14' Niles-Bement-Pond Roll
Am. Chip Wringers (New) 3.3 to 12.6 bushel capacity
No. 6 R & K Straight-side Press, M.D.
4-B Marvel Hack Saw
48"-14 Ga. Economy Shear, M.D.
No. 5 Reynolds Power Screw Driver

PLANERS

36"x36"x12' Cincinnati, 2 hds.
36"x36"x12' Gray, 2 Hds.
42"x42"x10' Cincinnati 2 hds.
48"x36"x14' Gray, 2 hds.
48"x48"x12' Cincinnati; 2 hds.

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AUTOMATICS

⅜" No. 204 New Britain 6 spdl.
⅞" Gridley Model G.
1½" Cone 4 spindle
No. 454 New Britain Chucking
14"x19" Fay
14"x18" Monarch Magnamatics

BORING MILLS

84" Gisholt
2½" Cleveland horiz., long bed
3" Rockford
4" Detrick & Harvey floor type
No. 5D Moline 6 spdl. cylinder bore

DRILLS

14" Leland Gifford, 1, 2 & 4 spdl.
14", 4 spdl Buffalo sensitive
15", No. 2 Avey, 1 & 4 spdl., hydr. feed
16" Sipp, 2 & 3 spindle
24", No. 4B Edlund, power feed
20" & 24" Barnes all geared self oiling
21" & 24" Cincinnati
Nos. 121, 217, 310, 315 & 321 Baker
No. 217H Baker horizontal
Barnes horizontal radial
3' Carlton sensitive radial
3'-10" & 6'-15" Dreses
16 spindle No. 13 Natco multiple
1 & 4 spdl. Avey No. 2, woodpecker feed
7 spdl. Moline horiz. hydr.
12 spdl. Defiance adjustable rail

GEAR CUTTERS

Nos. 6 & 7125A Fellows shapers
Nos. 8H, 12H, 16HS, 18H G. & E.
No. 130 Cleveland Rigidhobber
No. 5A Lees Bradner hobber
4" Gleason spiral bevel
Gleason testers & lappers
Illinois involute tester
Red Ring shavers, lappers & speeders

GRINDERS, CYLINDRICAL

10"x18" Norton, plain & semi-auto.
10"x18" Landis hydraulic
10"x24" & 16"x72" Landis mechanical
14"x36" Landis hydraulic universal
10"x18", 10"x30" & 10"x50" Norton mech.

GRINDERS, INTERNAL

No. 75A Heald hand feed
Nos. 72A3 & 72A5 Heald
No. 72A3 Heald, cross sliding, head
No. 72A3 Heald Sizematic
Nos. 16-28 16F28 & 24-36 Bryant
Granby bench type

GRINDERS, SURFACE

Nos. 10 & 16A2 Blanchard rotary
12" & 16", No. 22 Heald rotary
8" Pratt & Whitney rotary (tub)
14"x36" Pratt & Whitney vertical
8"x24", No. 78 Wilmarth & Morman
8"x22", No. 3 Abrasive
14"x48", No. 5 Abrasive

MILLERS

No. 2A Milwaukee
No. 2 Cincinnati, horiz. & vertical
12" Cincinnati Plain Mfg.
18" & 24" Cincinnati plain automatic
No. 4-36 Cincinnati Hydromatic
18", 24" Cincinnati duplex
No. 1-8 & 1-14 Kent Owens hydraulic
Nos. 1, 2 & 3 Kent Owens hand
No. 1 Kent Owens semi-automatic
20"x84" table Ingersoll vertical
Ingersoll Rise & Fall
6 spindle Moline profiler
24"x18"x14" Ingersoll planer
48"x24"x22" Ingersoll planer
30" Newton rotary
30", 42" & 84" Ingersoll rotary
No. CT 36 Lees Bradner thread
Nos. 4 & 6 Lees Bradner Univ. thread

SHAPERS & PLANERS

24" Queen City Shaper
27" & 34" Morton Draw Cut Shapers
16" Bement Miles slotter
36"x36"x8' Gray planer

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LATE MODEL TOOLS

BORING MILLS

No. 31 LUCAS Horizontal Boring, Drilling & Milling Machine, 3" bar
No. 25RT G. & L. Horizontal Boring, Drilling & Milling Machine
36" and 42" BULLARD Vertical Turret Lathes

LATHES

12"x30" MONARCH Model CK Toolroom
12"x30" HENDEY 18-Speed Geared Head, Tirm.
13"x4' bed SOUTH BEND underneath M.D. Precision Lathe
14"x54" HENDEY Geared Head Engine Lathe
16"x7' bed SOUTH BEND Toolroom Precision
20"x8' AMERICAN Geared Head Lathe

AUTO. LATHES & TURRETS

No. 2 B & O Geared Electric Turret Lathe
No. 5 DE POTTER & JOHNSTON Auto. Tur. Lathe
No. 6S POTTER & JOHNSTON Auto. Turret Lathe

MILLING MACHINES

No. 2H K&T Plain Miller
No. 2HL K&T Plain Miller
No. 26 VAN NORMAN Ray Type Univ. Miller
No. 12M MOREY 2-spindle Vert. Miller & Profiler, 1942
36"x36"x16' INGERSOLL Adjustable Rail Planer Type Miller, 40 HP AC motor drive, One Rail Head, Two Side Heads
No. 08 CINCINNATI Plain & Vert. Auto. Millers

GRINDERS

6"x18" LANDIS TYPE C Plain Grinder
10"x18" LANDIS Type C Plain Grinder
6"x18" NORTON Vert. Spindle Surface Grinder
10"x72" LANDIS Type C Hyd. Pl. Grinder, '42
16"x96" LANDIS Type B Pl. Cyl. with Gap Bed
No. 16-28 BRYANT Hyd. Internal Grinder
No. 174 HEALD Hyd. Gap Internal Grinder
No. 2 NORTON Tool & Cutter Grinder

DRILLS

No. 2LMS LELAND GIFFORD 2-spindle on 4-spindle base
No. 3MS LELAND GIFFORD 2-spindle, hydr. fd.
No. 425 BAKER H.D. Single Spindle Drill

GEAR EQUIPMENT

No. 725A FELLOWS High Speed Gear Shaper
No. 36BM GOULD & EBERHARDT Gear Rougher
No. 12 FELLOWS Gear Shaver

MISCELLANEOUS

15" BETTS Vert. Slotter, M.D.
16" GEMCO Shaper, M.D.
36"x36"x10' CINCINNATI D.H. Planer, 3 heads, M.D.
No. 1½B P & W Two Spindle Reaming Mach., '44
4½"x36" PRATT & WHITNEY Model C Thread Miller
Model H-1 MICROMATIC Hydrohoner
6" TAYLOR & FENN Spline Millers
⅞" CONOMATIC 4-spindle Auto. Screw Mach.
4¾" CONOMATIC 4-spdle. automatic screw machines

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Conomatic 4-Spindle—Capacity 4¾" round, 4¼" hexagon, 3⅝" square. Arranged for bar work—MD—1944 machine.

New Britain ⅄60 6-Spindle Automatic Screw Machine—1"x5" capacity. Threading attachment—stock reel and stand—considerable quantity of tooling—MD—Late Type.

Reed-Prentice #4 "Improved" Hydraulic Vertical Miller—Range 48"x24"x12"—Table working surface 70"x24"—MD—Late Type.

Cincinnati ⅄56-96 Plain Hydromatic Miller—Range 96"x8"x13¼"—Table 24"x19⅝"—Late Type.

Niles-Bement-Pond 48"x30" centers Engine Lathe—geared head—Quick Change gears—2 carriages—taper attachment—power rapid traverse—Late Type.

Brown & Sharpe #1 and #2 Universal Grinders—Capacities 10"x20" and 14"x30"—MD—Late Type.

Landis 6"x18" Type "C" Hydraulic Cylindrical Grinder—Four motor drive—Power rapid traverse—Late Type.

Norton ⅄2 Hydraulic Universal Tool & Cutter Grinder — 12" swing — Universal workhead — quantity of equipment—MD—Late Type.

Jones & Lamson 6"x15" Model TG615 Automatic Thread Grinder—Complete with blower and refrigeration unit—MD—Late Type.

Blanchard ⅄16A Automatic Dial Type Rotary Surface Grinder—30" chuck—30 HP AC motor—1943 machine.

This is only a partial listing. Many more to select from.

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LATEST TYPE *Nearly New* MACHINES

BORING MILLS—Horizontal
FRANKLIN 4¾" Bar; table type; M.D.
LANDIS #40, 4" Bar; floor type; M.D.
LANDIS No. 35 3½" floor type; Bar
NILES 8" bar floor type, motor drive

BORING MILLS—Vertical
BULLARD 16" 6-spindle "A" Mult-au-matic;
NILES 36-44" side head; M.D. Late
NILES-BEMENT-POND 144"; hvy M.D.

BROACHES
AMERICAN Mod 6-G Hydr. Rifle Broach
CINCINNATI 1-30 Duplex Vert. Hydr.
LaPOINTE #2L M.D. Late

CRANES
MILWAUKEE 5-ton; spans, 22'2"; 24'; 25'; 26'11"; 37'2"
MILWAUKEE 10-ton; span, 36'
MILWAUKEE 25-ton; span, 34'4"

DRILLS—Miscellaneous
BARNES No. 420 Deep Hole; late
BARNES H-3 Hydram; hydr.; Inverted; late
BARNES H-2 Hydram; hydr.; M.D.
BARNES 20" 4-spindle; Camel Back; Late
BARNES 24" all geared; Camel Back; M.D.
BAUSH 1¼x30" Deep Hole; Late
EDLUND 2B, 3-spindle; 1⅝" Dia.
MOLINE 6-spindle Multiple Hole-Hog; 3⅝" dia.; M.D.
NATCO No. 14 Mult.; Rect. Hd.; PRT; M.D.
NATCO D-5 Multiple; adjustable; Late
RODINE #42-20 multi-univ., dial feed; M.D.

RADIAL DRILLS
CARLTON 6'17" plain; M.D.
CINCINNATI BICKFORD 6'15" Univ.; M.D.
DRESSES 5'15" Universal; M.D.

GEAR CUTTING EQUIPMENT
BROWN & SHARPE #13 Spur Bevel Cutter
BROWN & SHARPE 6-72" Auto. Cutter; M.D.
CROSS No. 1 Tooth Rounder; M.D.
FELLOWS Nos. 6IA, 6Z2, 7I5, 7S, 7, 7A, 7S, 72, 77 High Speed Gear Shapers; late
FELLOWS 8-M Involute Meas. Instr.; Late
FELLOWS 12-M Red-Liner; M.D.; Late
FELLOWS 18-LS Lapper; late
GLEASON 3" & 12" Straight Bevel Gen.; late
GLEASON 10", 11" & 18" Bevel Gear Gen.
GLEASON 24", 37", 77", 96" Bevel Gear Planers; M.D.
GLEASON No. 14 Hypoid Grinder; late
PRATT & WHITNEY 10" Gear Grinder; late
SYKES #4A gear generator; M.D.
SYKES #8A gear generator; M.D.

GEAR HOBBERS
BARBER COLMAN #12 dble. overarm; M.D.
GOULD & EBERHARDT #24H. Late
GOULD & EBERHARDT #36BM 3 spindle Auto. Rougher; M.D.
KOEFFER WM-11 Auto.; bench type; Late

GRINDERS—Plain Cyl. & Univ.
LANDIS 4x18" Type H. Latest
LANDIS 6x18" Type C Plain; Hydr.; late
LANDIS 12x24" Type C. Late
LANDIS 10x18" type C plain Hydr. M.D.
LANDIS 29"x130" centers Plain; M.D.
LANDIS 10x24; plain motor drie
LANDIS 4x18 type H; M.D.; late
MONARCH 22" x456" centers Model CM Precision Engine Lathe; Helical geared; TIMKEN bearing; M.D.
NORTON 6x30 plain; motor drive
NORTON 10x72" type C Plain; Late
NORTON 17x42" centers crankpin; Hydr. Dble. hd.; M.D.

GRINDERS—Miscellaneous
BRYANT No. 3, 5, 5A, 16-C16, 16-CP-16, 24-26" Internal hydr.; Late
GLEASON No. 12 Tool Sharpener; late
HEALD No. 22 rotary surface; M.D.
HEALD No. 72-A-5 "Gagematic" Int.; Late
HEALD No. 72-A-8 "Gagematic" Int.; Late
LEMPCO 22x72" Mod. KG Crankshaft; Late
PRATT & WHITNEY B 14x36" Hydr.; Late
SHEFFIELD Micro-Form Grinder; late
VAN NORMAN 666 Crankshaft Regrind
VAN NORMAN 639 Osc. type Radius; Late

LATHES ENGINE & MFG.
AMERICAN 24"x220" centers; Timken; Late
AMERICAN 36"x360" centers; 2 carriages
AMERICAN 36"x33' centers geared; heavy
HARDINGE T.R.59 Bench type; Late
JONES & LAMSON "FAY" 20x25" Automatic; M.D.; Late
LEHMANN 25x96" entr; TIMKEN; grd M.D.
LeBLOND 16x36" cent.; Auto.; Timken; late
LeBLOND Mod. 7ACL Crankshaft; M.D.
LODGE & SHIPLEY 24x120" centers, Late
LODGE & SHIPLEY No. 5—24" and 96" centers DUOMATIC; Timken; Late
LoSWING 4x60", 8x24", 6x108"; late
MONARCH 22x456", 3 carr. CM TIMKEN
MONARCH 14x42" centers "Z" Magnamatic Auto.; TIMKEN; M.D.; Late
NILES 30"x50' Boring "Time-Saver"; Timken; Late
NILES 48"x32' centers Engine; geared; M.D.
REED PRENTICE 16"x24" centers grd; M.D.
SPRINGFIELD 14"x43", geared; M.D.

LATHES—TURRET
GISHOLT No. 3, 4, 5 Ram; TIMKEN; Late
MOREY No. 2, 3 ram type TIMKEN

MILLING MACHINES—Plain
BROWN & SHARPE #12, Late
CINCINNATI 0-8; M.D.; Late
CINCINNATI 4-48, 4 spindle, Tracer; Late
CINCINNATI # 24 Duplex; SPD
GOULD & EBERHARDT 25 Cont. type; M.D.
CINCINNATI No. 4 High Power; TIMKEN; Rect. M.D.
HERO #4P. New
SUNDSTRAND No. 3 Rigidmill; TIMKEN Late
TEGARD #1 Plain. New

MILLING MACHINES—MFG.
HALL Style D Planetary; Late
INGERSOLL 32x24x16' Planer Type; 2 hds
INGERSOLL 30x24x12' Ajd. Rail Slab; M.D.
INGERSOLL 42"x42"x16', 4 heads, Planer Type, Late
LEES BRADNER 14x54" HT Thread. Late
SUNDSTRAND Mod 3A Duplex 42" feed M.D.
TAYLOR & FEN M-80 Duplex Spline; Late

MILLING MACHINES—Vertical
CINCINNATI 0-8 Mod EA Automatic PRT; M.D.; Late

MILLING MACHINES—Thread
LEES BRADNER HT 12"x36" M.D. Late
MOREY 12x80", 12x60" centers; late
PRATT & WHITNEY 4½x12 Mod. C; late
PRATT & WHITNEY 6x132; M.D.

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B E T T S (CONSOLIDATED) 108" x 84" x 44' 4 heads; PRT; Box Table; M.D.
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DETRICK & HARVEY 48"x48"x16' hydr.
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LIBERTY 72"x48"x20' 4 heads; Convertible openside vari-voltage drive; late
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SELLERS 60"x60"x12' 4 heads vari-voltage dr.; PRT
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HELLER Model S8-1, 6¾" Cap Cold Saw

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LeMAIRE 18" Vertical Hydraulic; Late
PRATT & WHITNEY 6" Vertical; M.D.
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GLEASON 15", 25" Quenching; hydr.; M.D.
NIAGARA No. 512 DG tie rod; 282 tons; M.D.
UNITED ENG. 500 ton hydr. forging

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AJAX 3½" forging, upsetting; M.D.
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BAKER #5 Keyseater; motor drive
BARNES No. 172, 214 Honing; hydr.; Late
DeLAVAL No. 194 Coolant Clarifier; Late
FISCHER No. 1, No. 2 Oil Groover; Late
FOSTER 4x36" centers; Superfinisher; Late
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MANVILLE 2C Auto Screw Slotter; M.D.
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MANVILLE No. 3 Rehsaders; Late
MANVILLE No. 3C Thread Roller; M.D.
WATERBURY FARREL No. 11 Thread Roller; M.D.
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US TOOL 810-B Cutter Reliever; Late
NORTON 2F, 26F Lapping Machines; Late

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10x48" Norton C, semi-auto. cylindrical
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73 Heald Internal, 1944, like new
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#5 Gallmeyer & Livingston surface, hyd.
#2 Cincinnati Universal and T & C
#76RA Rogers knife grinder, 76"
P & W deep hole drill grinder, late
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Oliver single point tool
Model 1311 P & W contour, late
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5 HP Marschke, single end

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#5 Footburt, 4 spindle, #5 M.T.
150 Baker, single, #4 M.T., late
#1½ Avey, 4 spdle., high speed
#2 Detroit Semi-automatic
Kruger 16", six station
Type 14 Natco 12 spindle
#2 LMS Leland-Gifford 4 spindle deep hole
#2 Bausch 24 spdle., #2 M.T.
D6 Colburn, single spindle, #5 M.T.
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Moline Hole Hog, 2 spindle, older

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7A Fellows, shaper, high speed, hvy dty
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36" x 14' centers, American, late

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#5 B & S vertical, knee type
24" Cincinnati Duplex
35 60 Cincinnati Hydromatic Duplex
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1-8 Kent Owens production, hydraulic
Universal head for #2H K & T
10C Van Norman Contour

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Whiting Converter, 2 ton cap., late
Lithdraw heat treat, 1200° F, late
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PROFILER: Betts, 2 spindle
COMPARATOR: J & L, 30" shadowgraph
BROACH: #4 Lapointe, horizontal
LAPPER: 86-36" Gardner, vert. spdle.
WELDERS: Hobart and P & H, Arc, 400 amp.
BULLDOZER: #2 Ajax High Speed, 30 ton
PLANER: 72x60"x13' Cincinnati
SHAPER: 24" Rockford hydraulic, late
24" Gould & Eberhardt, v ram
25" Smith & Mills, backgeared
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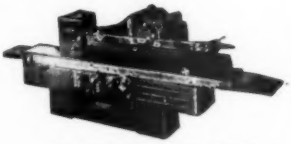
#2 Dalzen, 3" O.D., grinder
Model 40 Lees Bradner, miller
LT 6 x 36 Lees Bradner
#33 Excello External, grinder
#39 Excello Internal, grinder



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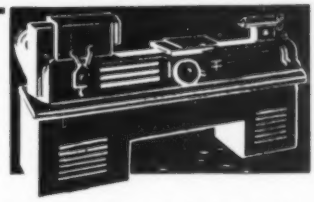

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Boring Mill, 60 Gisholt, vertical, 2 hds.
Boring Mill, 44" Bullard Maxi-Mill, Vert. PRT, M.D.
Boring Mill, 3½" N-B-P, horiz. table type.
Boring Mills, 54" Colburn, vertical, 2 hds., M.D.
Boring Mills, 36" Bullard vert. turret.
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Drill, Radial, 6' Dreses, gear box, M.D.
Drill, Radial, 8' Western, gear box, M.D.
Gear Hobber, #36H Gould & Eberhardt univ.
Gear Lapper, Type 10LS Fellows, 1942.
Grinder, Cylindrical, 6"x18" Cincinnati Filmatic, 1943 (3)
Grinder, Surface, 8"x54" Thompson, M.D.
Grinder, Surface, #34 Abrasive Vert., '41.
Grinder, #5 Bryant, Internal, late
Lathes, Duomatic, #3A Lodge & Shipley, 171" c.c., double carriage 1942.
Lathe, 36"x16' American 18 speed grd. hd., M.D.
Lathe, 6—20"x10' Americans, 12 speed grd. hd., M.D.
Lathe, 54"x20' Johnson, taper, M.D.

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Lathe, 16"x8' American, taper, M. in base.
Lathe, Automatic, 12"x24" Lipe-Carbo.
Lathe, Production, 8"x60" Lo-Swing, late.
Miller, Production, #1-12 Cincinnati, 1942.
Miller, Universal, #4 Cincinnati, Hi-Power, M.D.
Miller, Plain, #1½B Milwaukee, M.D.
Miller, Vertical, #14 Cochrane Bly, slot. attach.
Planer, 36"x36"x12' Cincinnati, 2 hds., M.D.
Shaper, 32" Cincinnati, gear box, M.D.
Turret Lathe, #2A Warner & Swasey, collets.
Turret Lathe, #0 B. & S. wire feed, collets, 1942.
Turret Lathe, #2G Morey, bar, collets, 1942.
Turret Lathe, #2 Bardon & Oliver, 1943.
Welder, 50 KVA Acme air-press, spot, timer, late.

PIPE THREADERS:
3—#8R Oster "Rapiduction" 8" cap. M.D., 1943
1—8" Landis, 4½"-8" cap., AC M.D.
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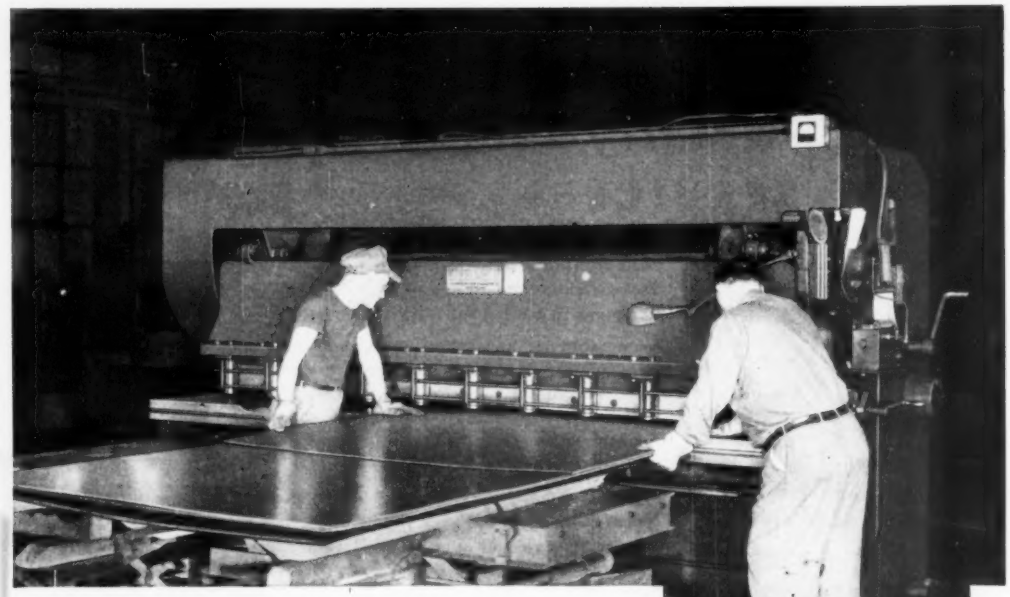

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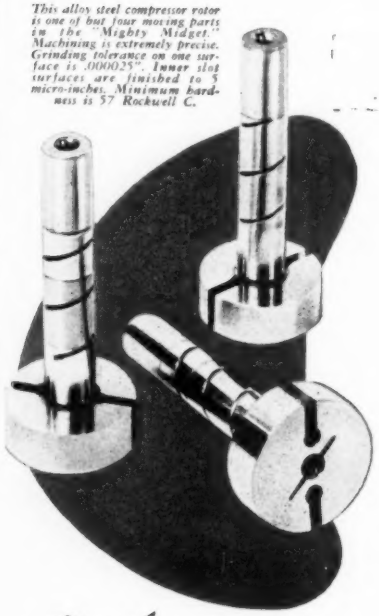

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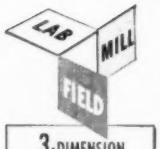

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More than America spent to win its Independence

THE Revolutionary War lasted 8 years and its direct cost was $74,555,642.

This sum is considerably less than the amount Youngstown is spending on expansion--its share of the steel industry's program to help preserve America's 175-year-old freedom from Communistic attack.

Work on a $90,000,000 construction project at the Indiana Harbor Works, East Chicago, Indiana, is under way. It includes a 1500-ton blast furnace, 75 new coke ovens and 8 - 250 ton open hearth furnaces, heating furnaces, a high-lift blooming mill, with 6 - 3 hole recuperative soaking pits, ore dock extension, unloaders and ore bridge, and a vast array of other facilities needed to produce the additional 1,000,000 ingot tons of steel involved. By the end of 1952, the steel industry expansion program will raise the total steel producing capacity of the United States to over 117-million ingot tons. This is more steel than is made in all the rest of the world combined.

This tremendous investment by the shareholders of private industry is possible only with adequate profit--profit earned in the past and to be earned in the future. This is a symbol of public confidence--confidence that the American system of free enterprise is right *and worth saving.* Confidence that it will continue to be our way of life through the years ahead.

Scrap Metal is Critical Again

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

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Service Beyond The Sale!

Cross-section illustrating the exclusive Mallory Fluted water hole.

Mallory Fluted* and Bent** Offset Tips

...the ultimate for your welders

REASONS WHY MALLORY FLUTED TIPS ARE SETTING WELDING RECORDS

- 70% increase in cooling area.
- Positive tube centering.
- Faster heat dissipation.
- Reduced mushrooming.
- Less frequent dressing.
- More rigidity.

Available in all types of tips with #1, #2, and #3 Morse tapers.

*Patent Pending

**U. S. Patent 2,489,993

Practical and effective contributions to cost reduction result from Mallory resistance welding research.

Major contributions are Mallory fluted and bent offset tips, giving you these important advantages:

Cold bent from standard tips with all the desirable physical properties of full hard, extruded and drawn bar stock, not obtainable in forgings or castings.

Water tubes bent in place, bringing effective cooling closer to the welding face.

Fluted water hole increases cooling area 70%, with corresponding increase in heat dissipation.

These exclusive features mean longer tip life, more uniform welds, fewer "downs" for dressing and lower costs . . . all yours at competitive prices!

That's service beyond the sale!

Mallory resistance welding know-how is at your disposal. What Mallory has done for others can be done for you!

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

Resistance Welding Tips, Holders, Dies, Rod and Bars, Castings, Forgings

P. R. MALLORY & CO. Inc.

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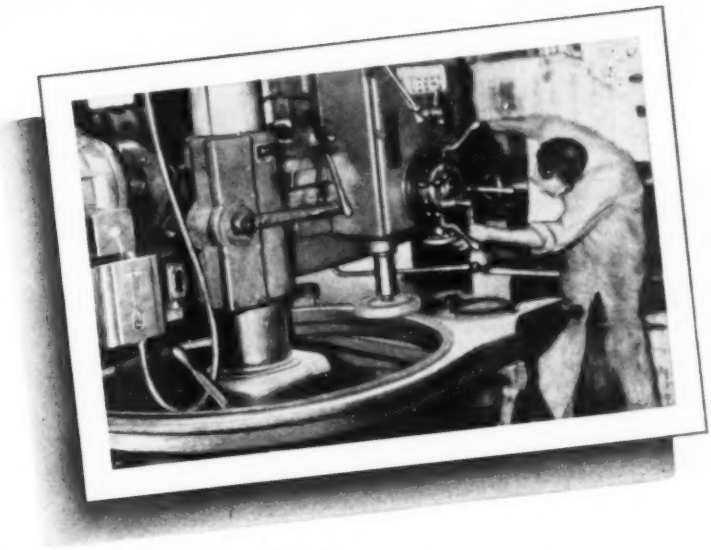
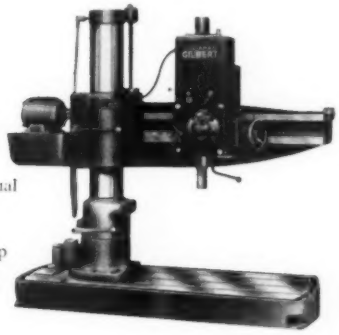


"...never tell 'em it can't be done."

At the James Machine Works, Monroe, Louisiana, they have a reputation for never telling a customer "it can't be done." They've earned it with good tools, plus ingenuity. Here's one example—a 60" diameter swing check valve seat, built up by welding, was to be faced smooth and flat. Lugs on the casting ruled out their boring mill. H. M. James wrote us how the job was done. They placed the valve over a Cincinnati Gilbert radial, made a spindle adapter for a 12" cup-type wheel . . . then ground the face by swinging the Gilbert arm 'round and 'round, feeding the grinding wheel downward. Result: a good job and a happy customer.



An unusual job, if you please, and an unusual demonstration of Gilbert radials' overall rigidity and precision *throughout a full 360° swing.* No wonder Gilbert users keep coming back again and again with repeat orders. Write for Bulletin 349.

THE CINCINNATI
GILBERT
MACHINE TOOL COMPANY
3366 BEEKMAN ST. • CINCINNATI 23, OHIO

RADIALS BORING MILLS ACCESSORIES

THOSE WHO BUY GILBERT BUY GILBERT AGAIN

TOUGH! — extreme hardenability, high tensile and fatigue strength, withstands 200,000 p.s.i. working pressures.

HARD! — can be oil-quenched in moderate sections to a maximum hardness of Rockwell C65/66.

EASY TO MACHINE! — excellent machinability because of fully spheroidized structure.

Ideal for parts like these:

1. Diesel injection pumps
2. Lathe centers
3. Slitting rolls and knives
4. Cam rollers for automotive steering gears
5. Machine tool parts
6. Pump parts
7. Aircraft engine parts
8. Mechanical seals
9. Saw mill rollers
10. Anti-friction bearings
11. Asbestos disintegrators
12. Mill rolls

—that's 52100 steel!

Here's a high carbon chromium steel that offers big advantages to manufacturers of machined parts requiring great strength and high resistance to wear. It's 52100 steel—originally developed by the Timken Company for anti-friction bearings.

Because it's hard and tough . . . and because of its excellent machining characteristics, 52100 is the ideal steel for a wide variety of applications. It has high fatigue strength and high tensile strength. When oil-quenched in moderate sections it has a maximum hardness of Rockwell C65/66. And it withstands a working pressure of 200,000 p.s.i. What's more, it's easy to machine—a result of spheroidized annealing.

The Timken Company—one of the world's largest producers of 52100—is the *only* source from which you can get *all three* finished forms of 52100 steel. Bars, tubes, and wire are available in a wide range of sizes. And for small run or emergency requirements, the Timken Company maintains a mill stock of 101 sizes in 52100 tubing —from 1" to 10½" O.D. Shipment is made within 24 hours after your order is received!

Most important, you can depend on uniformly high quality in every shipment of 52100 steel from the Timken Company. Quality is rigidly and completely controlled at every step in production—from melting to final inspection.

Write today for a stock list of available sizes, grades and finishes. And for detailed information on how 52100 steel can meet your particular need, consult our Technical Staff. Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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STEEL

and Seamless Tubes

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing